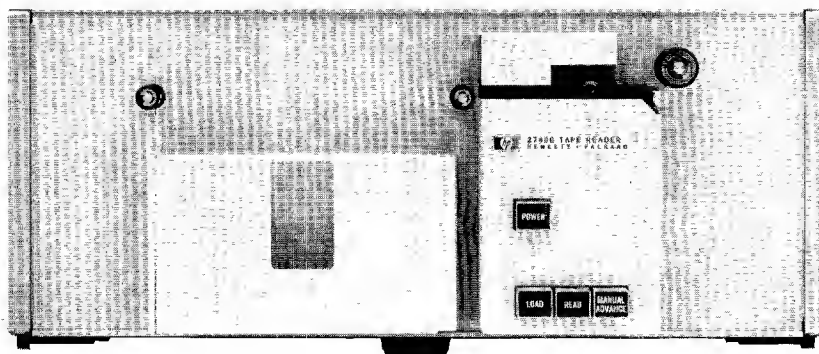


OPERATING AND SERVICE MANUAL

2748B TAPE READER



HEWLETT  PACKARD

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.



OPERATING AND SERVICE MANUAL

2748B

TAPE READER

Serial Numbers Prefixed: 1226

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1-1. INTRODUCTION.

1-2. This operating and service manual covers general information, installation, operation, theory of operation, and maintenance instructions for the Hewlett-Packard 2748B Tape Reader. (See figure 1-1.)

1-3. GENERAL DESCRIPTION.

1-4. The tape reader photoelectrically detects coded data characters punched on perforated tape. A unidirectional mechanical-drive mechanism advances the tape through the read head where phototransistors are used to detect the data. The tape reader accepts 8-track, 1-inch tape. Reading rate is up to 500 characters per second. Forward tape drive after loading is initiated by an external step command or by pressing the MANUAL ADVANCE push-button on the unit.

1-5. IDENTIFICATION.

1-6. Hewlett-Packard uses a nine-digit one-letter serial number (0000A00000) located on the rear panel to identify each unit. The first four digits are a special prefix number used to identify a special unit model. The last five digits identify each specific unit. The letter designates the country in which the unit was manufactured ("A" indicates the United States). If the serial number prefix on your unit

does not agree with those on the title page of this manual, there are differences between your unit and the unit described in this manual. These differences are described in manual supplements available at the nearest HP Sales and Service Office.

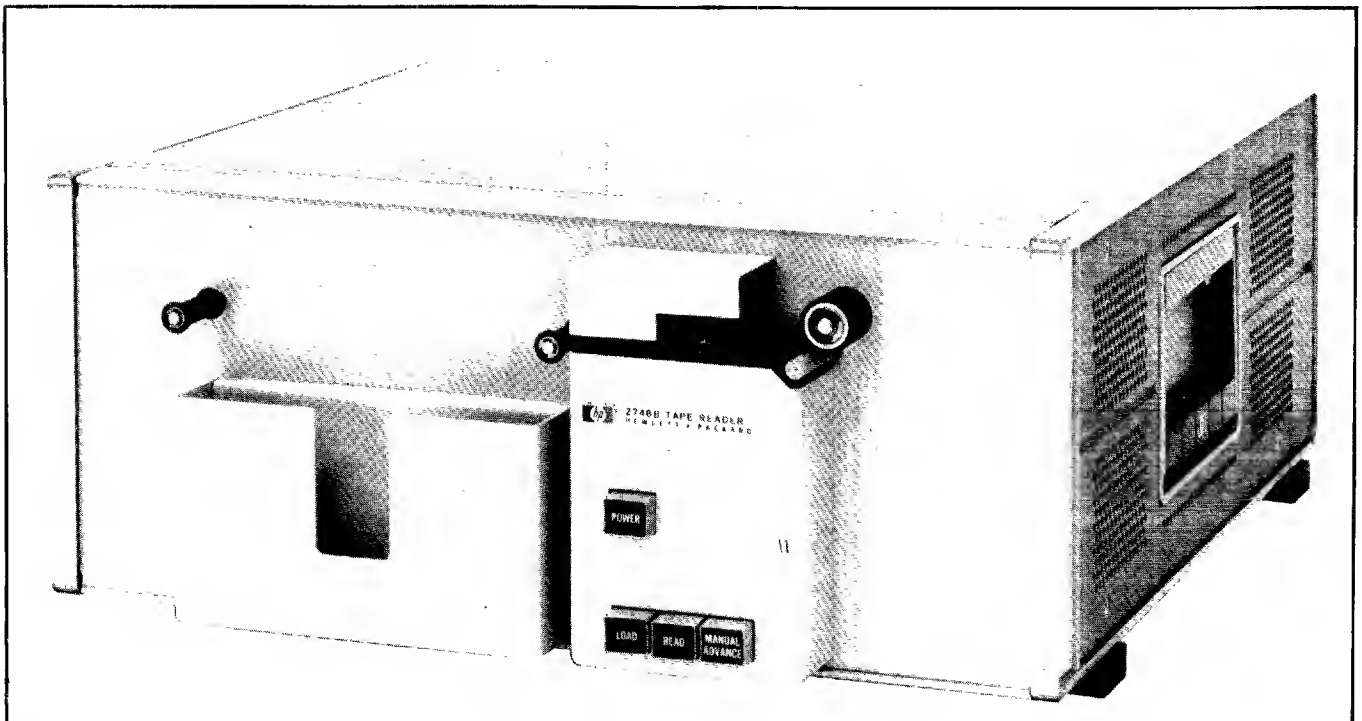
1-7. Printed-circuit assembly (PCA) revisions are identified by a letter, a series code, and a division code marked beneath the part number on the board. The letter identifies the etched trace pattern on the unloaded board. The three- or four-digit series code identifies a particular configuration of the loaded printed-circuit board. The two-digit division code identifies the division of Hewlett-Packard that manufactured the assembly. If the series code numbers do not correspond exactly with the code numbers on the schematics of this manual, the assemblies differ from those described in this manual. These differences are covered in manual supplements available at the nearest HP Sales and Service Office.

1-8. SPECIFICATIONS.

1-9. Specifications for the tape reader are listed in table 1-1.

1-10. OPTIONS.

1-11. Option 001 for the tape reader allows the unit to be operated from 230-volt ± 10 percent 50-hertz power.



2227-1

Figure 1-1. Hewlett-Packard 2748B Tape Reader

Table 1-1. HP 2748B Tape Reader Specifications

GENERAL

Power Requirement: 115 volts $\pm 10\%$, 60 hertz $\pm 5\%$, 240 watts maximum, or (with option 001) 230 volts $\pm 10\%$, 50 hertz $\pm 5\%$, 240 watts maximum

Mounting: Standard 19-inch (482.6-millimeter) rack

Panel Height: 7 inches (117.8 millimeters)

Width: 17 inches (431.8 millimeters)

Depth: 16 inches (406.4 millimeters)

Operating Temperature Range: 0° to +55°C (32° to 132°F)

Nonoperating Temperature Range: -40° to +75°C (-40° to 167°F)

Relative Humidity: 95 percent at +25° to +40°C

TAPE

Material: Any diffuse material with less than 60 percent transmissivity (Refer to paragraph 4-41.g.).

Code: 8 level

Width: 1 inch

SPEED

Reading: To 500 characters per second (415 characters per second when operated from 50-hertz power)

Stop Time: Less than 500 μ sec

Start Time: Less than 6 ms (up to full speed in ms)

INPUT SIGNAL DATA

Start Command: -12 to +1.5V

Stop Command: +2.0 to +24V

Maximum Input: -12V at 25 mA

Input Impedance: +24V at 15 mA

OUTPUT SIGNAL DATA (DATA AND FEEDHOLE SIGNALS)

	Feedhole	No Feedhole
Level:	0 to +1V	+12V
Impedance:	Saturated transistor	10k to +12V
Maximum Current:	12 mA	

FEEDHOLE AND DATA TRANSITION TIMES

	Rise 0V to +12V 90% Point	+12V to 0V 90% Point
No Load:	< 20 μ s	< 20 μ s
5000 pF Load:	< 150 μ s	< 20 μ s

INSTALLATION AND OPERATION

SECTION II

2-1. INTRODUCTION.

2-2. This section contains information on unpacking, inspection, installation, and operation for the tape reader.

2-3. INSTALLATION.

2-4. UNPACKING AND INSPECTION.

2-5. If the shipping carton is damaged upon receipt, request that the carrier's agent be present when the unit is unpacked. Inspect the unit for damage (scratches, dents, broken parts, etc.). If the unit is damaged and fails to meet specifications, notify the carrier and the nearest HP Sales and Service Office immediately. (Sales and Service Offices are listed at the back of this manual.) Retain the shipping container and the padding material for the carrier's inspection. Hewlett-Packard will arrange for repair or replacement of the damaged unit without waiting for any claims against the carrier to be settled.

2-6. RACK OR BENCH MOUNTING.

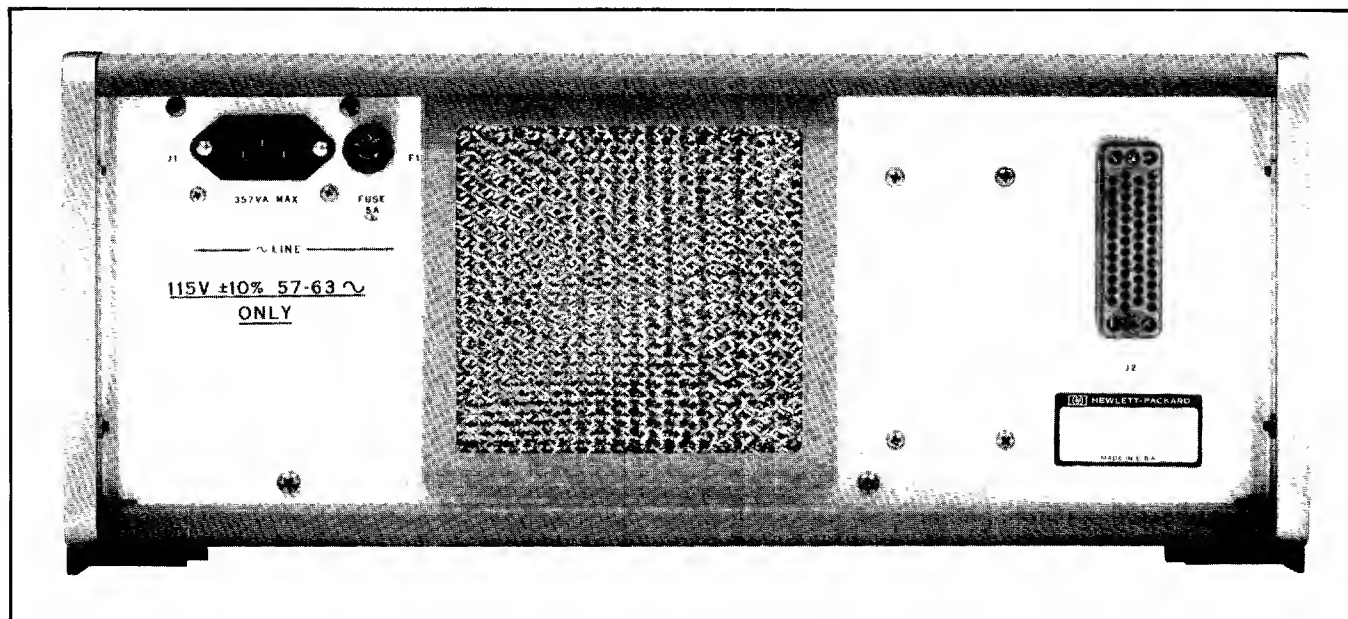
2-7. The tape reader is designed for either bench installation or mounting in a standard 19-inch rack. To mount the unit in a rack, follow the instructions contained in the rack mounting kit furnished with the unit. All necessary hardware is furnished as part of the rack mounting kit.

2-8. All necessary accessories are supplied except interconnecting cables and interface kits for interfacing with

associated equipment. These cables will be supplied upon special order to the nearest Hewlett-Packard Sales and Service Office. The maximum interconnecting cable length is 50 feet. Pin assignments for interfacing connector J2 are listed in table 2-1. Figure 2-1 shows the rear panel of the tape reader.

Table 2-1. Pin Assignments for Connector J2

Connector J2, Pin	Function
B	Data Bit 1
F	Data Bit 2
L	Data Bit 3
R	Data Bit 4
V	Data Bit 5
Z	Data Bit 6
d	Data Bit 7
j	Data Bit 8
HH	Ground
AA	Read
FF	Feedhole
C	TTL Clamp
H	TTL Clamp
M	End of Tape
S	Ready



2227-2

Figure 2-1. Tape Reader Rear Panel

2-9. POWER REQUIREMENTS.

2-10. The tape reader operates from a 115-volt 60-Hz power source and requires 240 watts of power. The unit is protected from power overloads by a 5.0 ampere fuse which is located in a fuse holder on the rear panel. Check the ampere rating of the fuse supplied with the unit before applying power. If the unit includes option 001, operating power is 230 volts at 50 Hz, and the overload fuse is rated at 2.5 amperes.

2-11. A detachable three-conductor power cord is supplied with the unit. When operating the unit from a two-contact outlet, use a three-conductor to two-conductor adapter and connect the adapter ground wire to a suitable ground.

2-12. LUBRICATION.

2-13. The tape reader was lubricated before shipment and normally should not require lubrication before initial operation. However, failure to check the unit periodically for proper lubrication may result in serious and costly damage to the unit. Complete lubrication intervals and procedures are provided in section IV of this manual.

2-14. SHIPPING INSTRUCTIONS.

2-15. If the unit is to be shipped to Hewlett-Packard for service or repair, attach a tag to the unit identifying the owner and indicating the service or repair to be accomplished. Include the model number and full serial number of the unit.

2-16. Place the unit in the original container if available. If the original container is not available, a suitable container and packing material can be purchased from a local Hewlett-Packard Sales and Service Office.

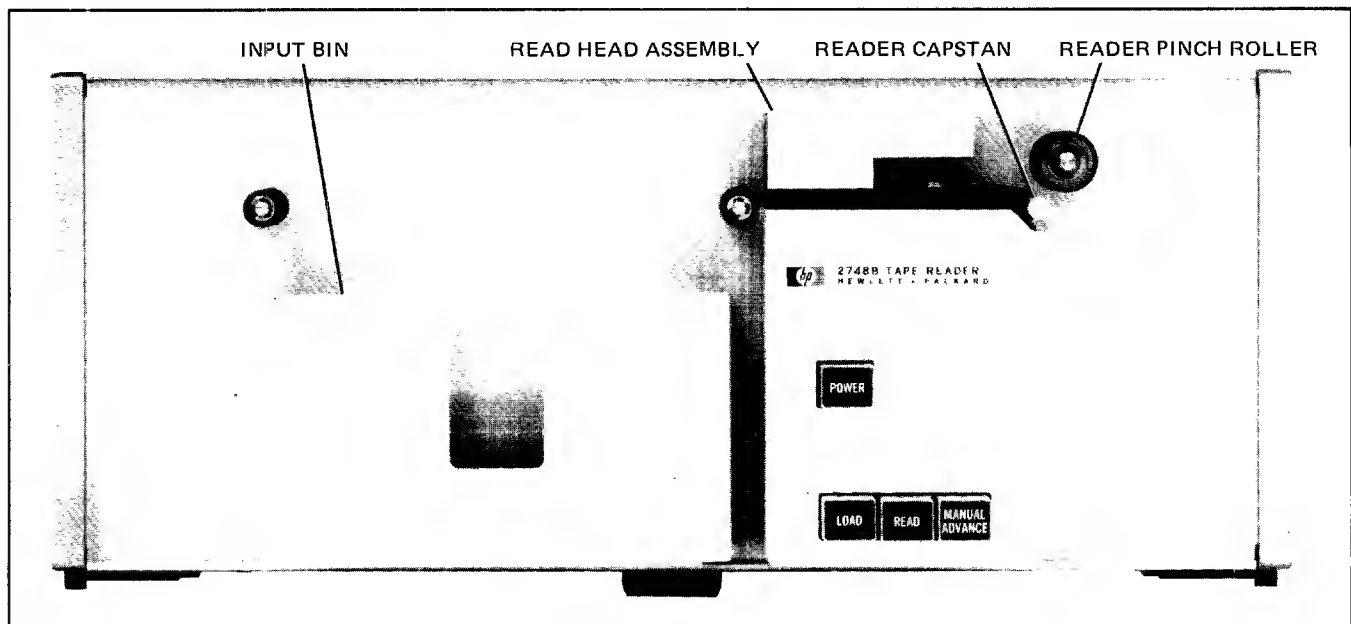
2-17. If the original container is not used, wrap the unit in heavy paper and place it in an inner container. Place adequate packing material around all sides of the unit and place a cardboard strip over the front panel. Place the unit and inner container in a heavy carton or wooden box and bind with strong tape or metal bands. Mark the shipping container "FRAGILE."

Note: In any correspondence, identify the unit by model number and serial number prefix. Refer any questions to the nearest Hewlett-Packard Sales and Service Office.

2-18. OPERATING CONTROLS.

2-19. Operating controls for the tape reader consist of four switches mounted on the front panel. (See figure 2-2.) Functions of the controls are as follows:

- POWER switch:** Applies primary ac power to the unit.
- LOAD switch:** Releases reader pinch roller and stops reader capstan to allow for tape threading. Feedhole signal is inhibited when switch is pressed. Pressing this switch releases the READ switch.
- READ switch:** Tape advances through the unit when switch is pressed and read command is present. Pressing this switch releases the LOAD switch.
- MANUAL ADVANCE switch:** Tape is allowed to advance only when switch is pressed and held. Pressing this switch inhibits the feedhole signal and releases both READ and LOAD switches.



2227-3

Figure 2-2. Tape Reader Front Panel

2-20. OPERATING INSTRUCTIONS.

2-21. Operating instructions for the tape reader are given in the following paragraphs. Load tape in accordance with paragraph 2-22 and operate unit as instructed in paragraph 2-26. The Operational Flowchart (figure 2-5) sequentially explains the various operations of the unit.

2-22. TAPE LOADING.

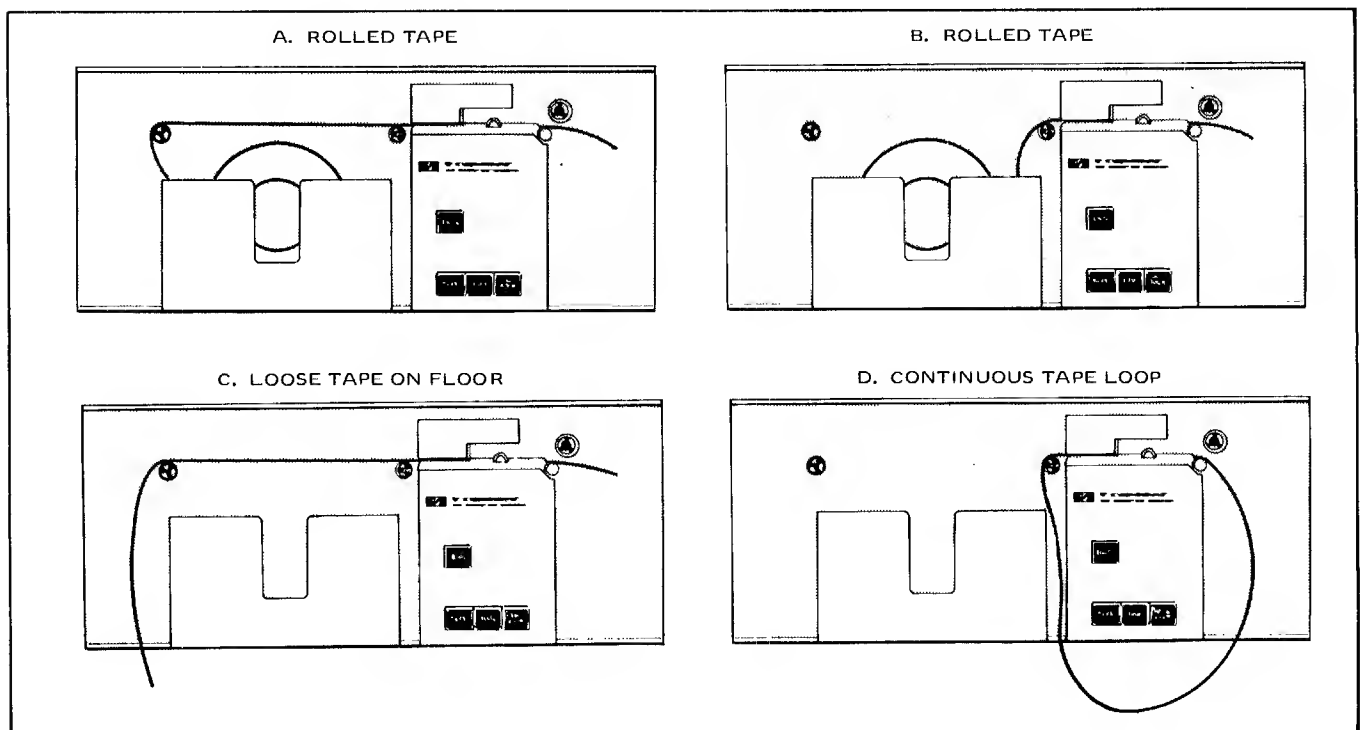
2-23. Before loading tape, energize the unit by pressing the POWER switch. Press the LOAD switch to release the reader pinch roller.

2-24. Tape can be loaded in the tape reader in one of four ways, as shown in figure 2-3. Make certain that as the tape moves left to right, the characters appear in the original sequence punched, and the feedholes are nearer the front panel of the unit. Tape that is rolled can be loaded as shown in figure 2-3A or 2-3B, depending on the location of the feedholes. Long, unrolled lengths of tape should be loaded in accordance with figure 2-3C, and continuous loops of tape should be loaded as shown in figure 2-3D.

2-25. When threading tape through the read head assembly, hold the leader end of the tape between the thumb and forefinger of both hands as shown in figure 2-4A. With the tape drawn tightly and at an angle to the read head assembly as shown in figure 2-4B, begin sliding the tape into the slot in the read head. Hold the tape down against the read head surface and slide the tape from left to right and back into the slot in the read head assembly (figure 2-4C). The tape should slip easily into the recessed tape guide slot and under the plastic-covered wire foot on the read head. The tape is shown in the final loaded position in figure 2-4D.

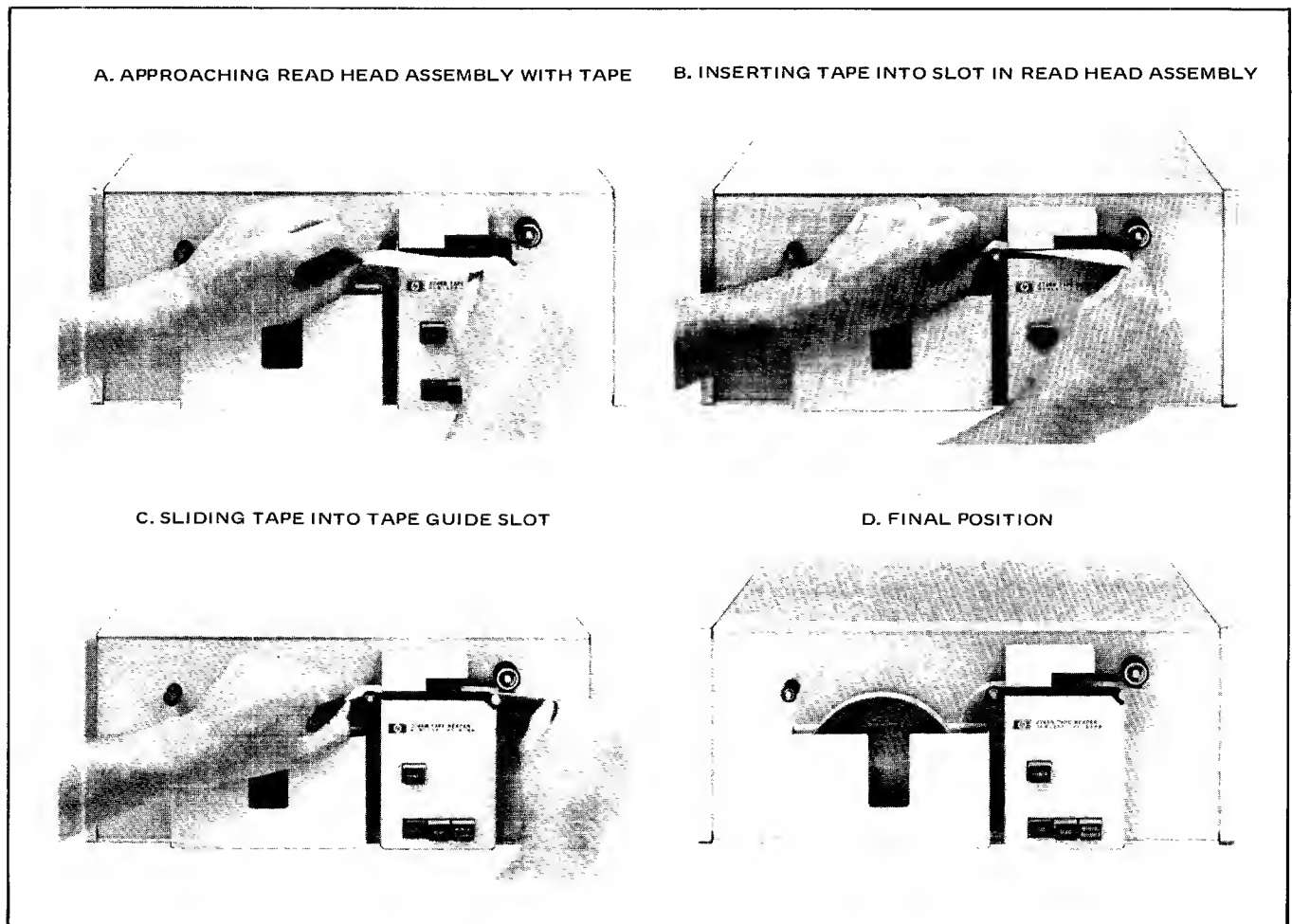
2-26. OPERATING PROCEDURES.

2-27. After the unit has been loaded, all that is required to begin operation is to press either the READ switch or the MANUAL ADVANCE switch, depending on the desired mode of operation. If the READ switch is pressed, tape will advance through the read head as long as a continuous read command is present. The MANUAL ADVANCE switch does not require a read command to advance the tape; however, the switch must be held on continuously to advance the tape through the read head. If the MANUAL ADVANCE switch is used to advance the tape, the feedhole signal will be inhibited.



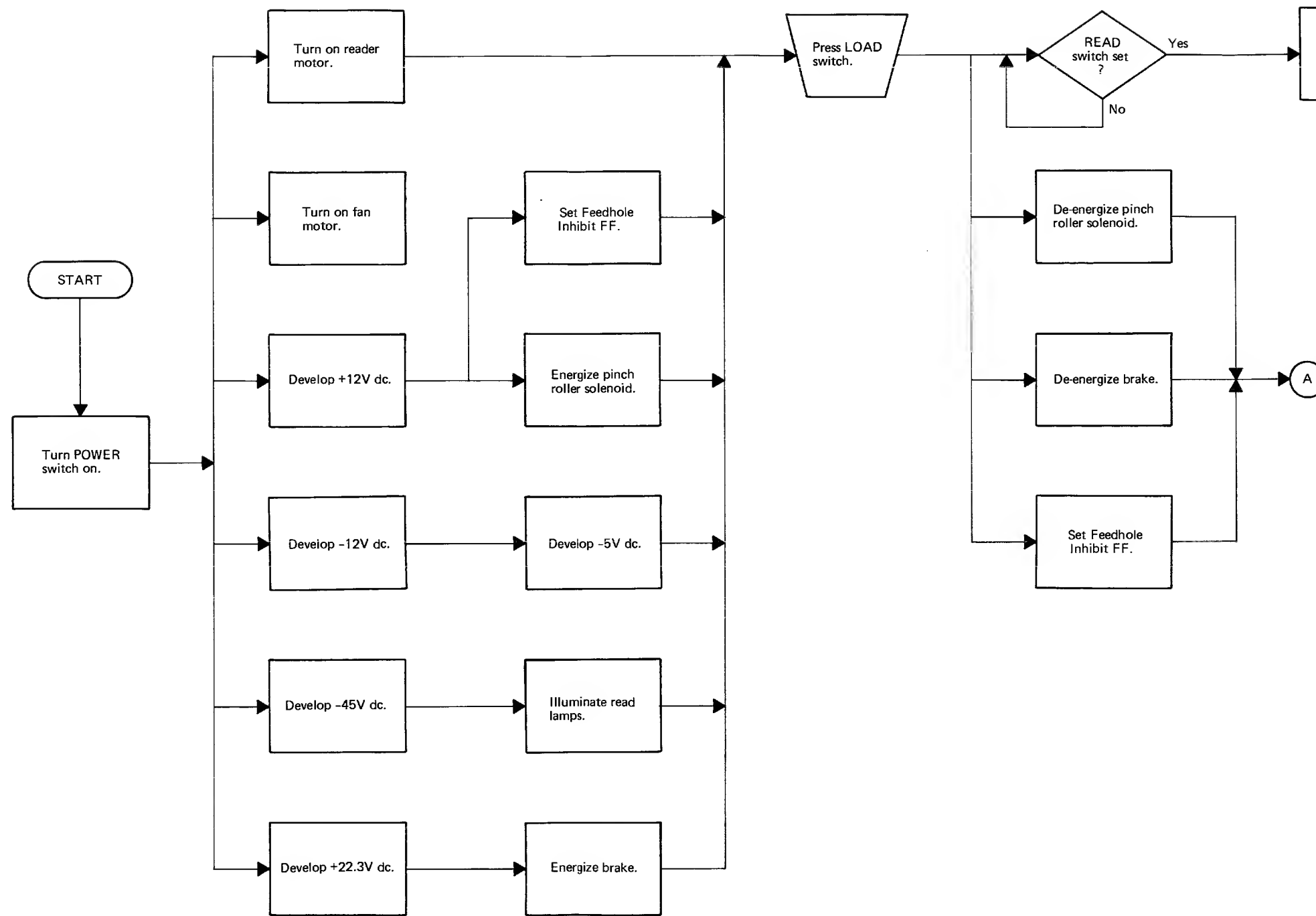
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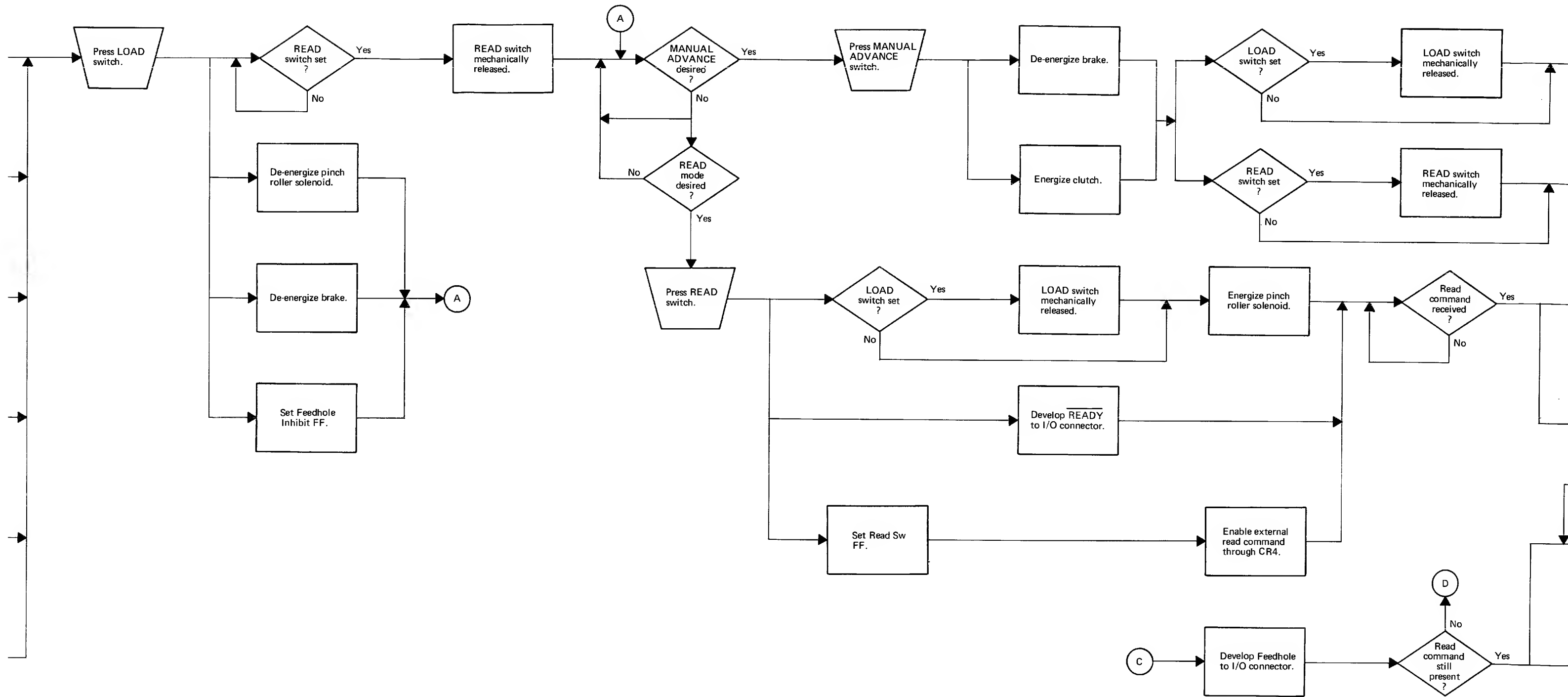
Figure 2-3. Tape Loading Diagram



2227-5

Figure 2-4. Tape Threading Diagram





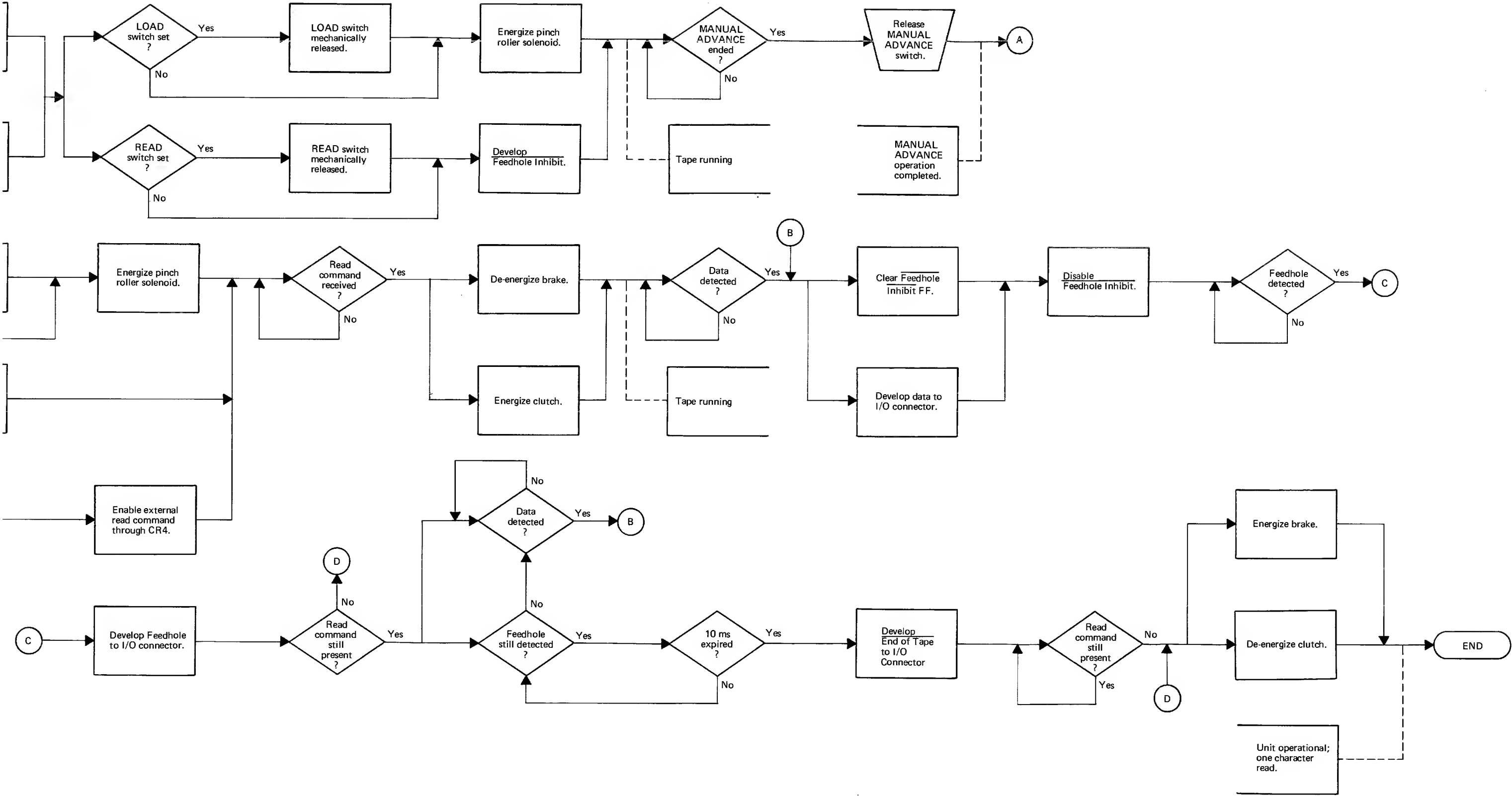


Figure 2-5. Operational Flowchart
2-5/2-6

3.1. INTRODUCTION.

3.2. This section contains an overall functional description and detailed circuit descriptions for the tape reader.

3.3. OVERALL FUNCTIONAL DESCRIPTION.

3.4. A functional block diagram of the tape reader is shown in figure 3-1. During operation, the punched tape being read passes between a light source and light-sensitive phototransistors. When holes in the tape permit light to reach the phototransistors, respective data bit outputs (eight possible) and a single feedhole output from the phototransistors are applied to amplifiers. The data bits are further amplified by interface amplifiers and applied to the computer or controlling device that is interpreting the data. The feedhole output is the trigger informing the computer when to input data. The output from the feedhole phototransistor is used to fire a Schmitt trigger rather than being applied directly to the computer. Use of the Schmitt trigger ensures that each character is read only once.

3.5. While in the READ mode of operation (READ switch on), unit operation is initiated by a read command from the computer. The read command is driven by an interface amplifier and applied to the unit control circuitry. The control circuitry releases the brake and engages the reader capstan clutch and the tape is advanced.

3.6. Stop and go circuitry controls the brake and clutch solenoids and allows the unit to read in a stop/go mode. When the read command is removed, the tape will be

stopped on the character initiating the stop without overshooting any characters. Reading will continue on the next character when data is present and the read command is restored.

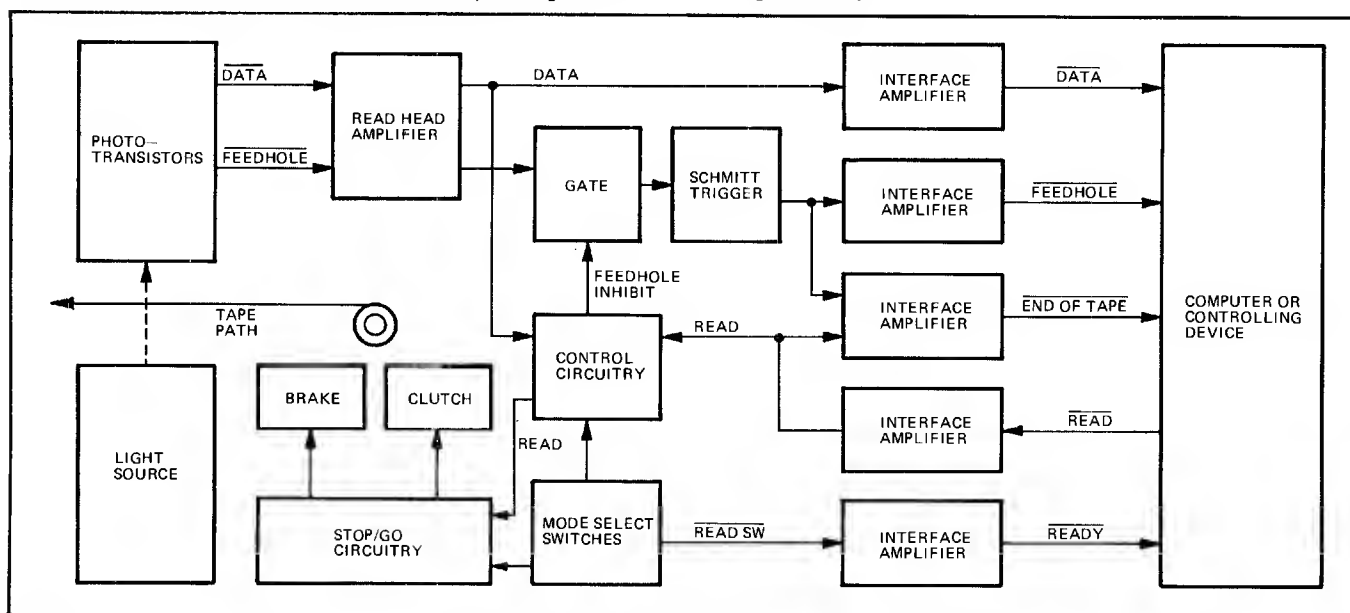
3.7. DETAILED CIRCUIT DESCRIPTIONS.

3.8. Detailed circuit descriptions of each of the functional circuits in the tape reader are provided in the following paragraphs. Schematic diagrams for each of these circuits are included in section IV of this manual.

3.9. READ HEAD ASSEMBLY A5.

3.10. Read head assembly A5 consists of phototransistors, a lamp and an amplifier for each phototransistor, a reference voltage circuit, and a brake solenoid. A schematic diagram of the complete assembly is shown in figure 4-7.

3.11. The lamps are located in the upper portion of read head assembly A5 on subassembly A5A3 and are accurately positioned over the tape holes by placing the tips of the lamp envelopes in guide holes. The lamps are series connected to provide burnout protection. If a single lamp filament opens, the lamp circuit opens and all lamps extinguish. This also provides some degree of protection against reading errors that might otherwise be caused by open lamp filaments. Variable resistor A5R13 controls the lamp intensity.



2227-6

Figure 3-1. Tape Reader Functional Block Diagram

3-12. Subassembly A5A2 contains the phototransistors. Each phototransistor has been selected and matched during manufacture to ensure close grouping of sensitivities within any one phototransistor subassembly.

3-13. The reference voltage circuit is included to compensate for changes in phototransistor sensitivity due to temperature changes. The reference voltage circuit uses a lamp (A5A3DS1) and a phototransistor (A5A2V1) that are essentially the same as those used to read the tape and will therefore be affected by temperature changes to the same extent. Transistor A5A1Q10 and emitter-follower A5A1Q9 act together to form a low-gain operational amplifier. Before light shines on A5A2V1, the voltage at the base of A5A1Q10 is near ground. When light shines on A5A2V1, a negative-going voltage change occurs at the base of A5A1Q10. The output of A5A1Q10 (and A5A1Q9) then goes positive, causing a current to flow through A5A1R2 and A5A1R3 in an amount approximately equal to the collector-to-emitter current in A5A2V1, thus maintaining the voltage at the base of A5A1Q10 near chassis potential. As light intensity or temperature increases, the current through A5A2V1 increases, and the output of amplifier A5A1Q9-A5A1Q10 increases in a proportional amount. In this manner, the desired reference voltage is maintained. The light path of the reference hole is enclosed to keep out dust and other debris that could obstruct the light path. Variable resistor A5A1R2 can be adjusted to compensate for differences in phototransistor sensitivities that may be experienced if it is necessary to replace a phototransistor subassembly.

3-14. During operation of the tape reader, the turn-on threshold level of the data amplifiers on A5A1 is controlled by the level of the reference voltage described previously. All eight data circuits are identical. Typically, if enough light hits A5A2V2, the collector-to-emitter current in A5A2V2 will exceed the sum of the current in A5A1R4 and the control current required to keep A5A1Q1 biased on, so A5A1Q1 will turn off. The voltage in the collector of A5A1Q1 will then rise to about +5.75V dc. When the light path to A5A2V2 is blocked, A5A1Q1 conducts to saturation and the collector voltage drops to about 0V dc.

3-15. The feedhole circuit is similar to that described above for the data circuits except that an emitter-follower is used as the output amplifier. Therefore, the negative-going output from the feedhole phototransistor is not inverted by the amplifier and the output at pin K of A5 is about 0 volts dc whenever a feedhole is sensed and +5.75 volts dc when the feedhole light path is cut off.

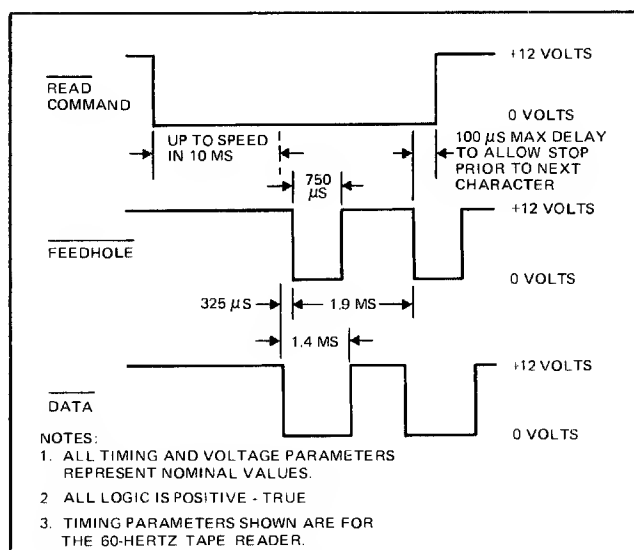
3-16. The brake circuit consists of a solenoid which energizes whenever a signal is received from control PCA A2. When the brake is de-energized, a spring-loaded iron disc in read head assembly A5 is held lightly against the paper tape. The spring prevents bouncing between the iron disc and the solenoid that could cause delays in stopping the tape when the brake is energized. When the solenoid is energized, the iron disc is attracted to the solenoid. This clamps the punched tape between the braking surfaces of the solenoid and the iron disc.

3-17. INTERFACE PCA A3.

3-18. The interface circuitry consists of eight data-bit amplifiers, a Schmitt trigger with a diode inhibit gate, an eight-input "or" gate, and twelve TTL/DTL clamping diodes. The "not" Ready and "not" End of Tape circuits are also discussed. A complete schematic diagram of interface PCA A3 shown in figure 4-8.

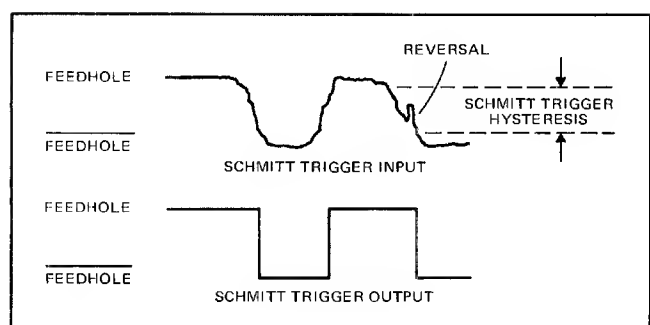
3-19. Transistors Q1 through Q8 amplify and invert the data bit signals from the read head assembly and apply the output signal to connector J2 on the rear panel of the tape reader. Base-to-collector capacitors on each amplifier slow the rise and fall times of the inverter outputs to prevent cross coupling between the output signals and other circuits.

3-20. The feedhole circuit utilizes a Schmitt trigger to ensure that each character on the punched tape is read only once. The location and size relationship of the feedhole to the data holes in the punched tape is such that the data holes will always be in position to be read when the feedhole is in position. Because of this relationship, the leading edge of the feedhole is used as the timing element to trigger the computer or controlling device to read. The computer or controlling device will look at the data only when the feedhole output goes low. Figure 3-2 shows the timing diagram for the tape reader using idealized waveforms. In reality, the feedhole waveform probably looks more like that shown in figure 3-3. Note the noise and slight reversals on the waveform that are caused by lint or paper fibers on the edges of the holes. The Schmitt trigger hysteresis is designed to ignore any reversals such as these and thus avoid re-reading a character. When pin 24 is near chassis potential, Q11 is held off and feedholes are not passed on to the device receiving the data. Common-emitter amplifiers Q12 and Q13 invert the Schmitt trigger output twice before passing the signal on to connector J2. Capacitor C4 slows the rise and fall times of the signal from Q13.



2227-7

Figure 3-2. Tape Reader Timing Diagram



2227-8

Figure 3-3. Feedhole Schmitt Trigger Input and Output Waveforms

3-21. Transistor Q9 inverts the “not” Read command from the computer or controlling device and provides sufficient gain to drive the control circuitry on control PCA A2. Input RC network R80, R81, R83, R85, and C2 slows the circuit response to prevent transients from operating the circuit.

3-22. The circuitry originating the “not” End of Tape signal consists of Q16 through Q19. The “not” End of Tape signal is originated when a feedhole signal with a duration of at least 10 ms and a Read command from the computer or controlling device are present. When tape is no longer present, the feedhole signal remains low. This low-level signal is applied to the base of Q19, promptly turning it off. When a Read command is sent from the computer or controlling device, it is coupled to the collector of Q19. The application of both the Feedhole signal and the Read command denies storage capacitor C7 a discharge path. C7 continues to charge until a sufficient positive level is obtained to turn on Q18. The output of Q18 is further amplified by Q17 and Q16, resulting in a low level status indicating signal to the computer.

3-23. With POWER and READ switches pressed, a “not” Ready signal is generated by Q14 and Q15. The “not” Ready signal tells the computer or controlling device that the tape reader is prepared to read tape.

3-24. Diodes CR2, 12, 22, 32, 42, 52, 62, 72, 81, 92, 93, 94 are clamped to a nominal +5V dc by zener diode CR80. The clamp voltage permits the tape reader to be directly interfaced with TTL/DTL logic.

3-25. CONTROL CIRCUITRY.

3-26. The control circuitry includes flip-flops, gates, and amplifiers on control PCA A2 and related components on the tape reader chassis. A schematic diagram of the control circuitry is shown in figure 4-9 and a logic diagram is shown in figure 4-6. Also, refer to the unit operational chart, table 4-3, to determine the states of the control components for each mode of operation. The primary function of the control circuit is to interpret commands from the computer or controlling device, the read head, and various instrument switch settings and to originate appropriate

signals to carry out these commands. Control PCA A2 outputs control the mechanical features of the tape reader to provide a specified mode of operation.

3-27. The brake and clutch circuit is designed to allow the tape being read to start and stop rapidly so that tape may be read in the start/stop mode and the tape may be stopped on command without overshooting characters. The inductive reactance of the brake and clutch solenoids normally makes these components slow to energize. Inductor L1 allows a higher voltage to be applied to the component being energized. For example, when the brake goes off and the clutch is energized, the clutch initially resists any change in current as does inductor L1. The brake circuit is now open and the clutch is refusing to conduct much current. The inductance of L1 tries to maintain its current level by increasing the voltage at the junction of L1 and K4 from about +22.3 volts dc to over +100 volts dc. This higher voltage across the clutch allows a rapid current buildup, and the clutch is pulled into operation more rapidly than would have been possible by +22.3 volts dc. The brake is also pulled into operation much more rapidly by the increased voltage at the junction of L1 and K4 than what was previously possible by +22.3 volts.

3-28. A clamping circuit made up of A2CR6, A2CR8, and zener diode CR71 limits the voltage level in the collectors of Q24 and Q25 to +125 volts dc to prevent damage to these transistors. Shunt resistor R72 over-compensates for the difference in current in the clutch and the brake and allows an extra high current to be switched into the brake solenoid when the brake is energized. Diodes A2CR10, A2CR7, and A2CR9 eliminate the possibility of the collectors of Q24 and Q25 being driven negative during the switching time. Diode A2CR7 also prevents current from recirculating through A2CR9, R72 and the clutch when it is de-energized. If this current were allowed to recirculate, the release of the clutch would be delayed.

3-29. When the LOAD switch is pressed, both Q24 and Q25 are turned off. At this moment, A2R7, A2C1, and A2C2 present a series resonant path allowing the high voltage stored in L1 a low impedance exit. This degaussing circuit demagnetizes the brake.

3-30. The “not” Read SW flip-flop consists primarily of transistors A2Q1 and A2Q2. This flip-flop is set or cleared by the READ switch on the front panel. The “not” Read SW flip-flop provides isolation between the switch contacts and the other control circuitry. Without this isolation, switch contact bounce could be interpreted as a series of pulsed signals.

3-31. The ability to inhibit the Feedhole signal until the first non-zero character is read following load status or power up is accomplished by the “not” Feedhole Inhibit FF, Q11 and Q12.

3-32. POWER SUPPLY PCA A1.

3-33. Power supply PCA A1 consists of four power supply circuits, which provide output voltages of ± 12 volts dc, -45 volts dc, and -5 volts dc. See figure 4-10 for a complete schematic diagram of power supply PCA A1 and appendix A for the equivalent schematic diagram of voltage regulators A1U1 and A1U2. The following paragraphs discuss each of these circuits.

3-34. **-12 VOLT CIRCUIT.** The -12 volt circuit uses fullwave bridge rectifier A1CR1 through A1CR4 to convert ac voltage from one set of secondary windings on transformer T1 to dc voltage. Voltage regulation is provided by integrated circuit A1U1, which is connected to utilize foldback current limiting. The unregulated -12 volt input from the bridge rectifier is applied to pin 3 of A1U1 and the regulated output is applied to pin 4 of A1U1. A booster output at pin 2 of A1U1 is amplified by A1Q3 and applied to amplifier Q1. Resistor A1R12 in the emitter circuit of Q1 is used as the current sensing device for overload protection. When the current through A1R12 becomes excessive, a more positive voltage will be applied to pin 1 of A1U1 by voltage divider A1R13 and A1R14. The voltage sensed at pin 1 of A1U1 causes the output voltage of the circuit to be reduced to a safe level. Removal of the overload condition will allow the output voltage to return to the normal level. The reference feedback voltage to pin 6 of A1U1 is adjustable by variable resistor A1R16, allowing the output voltage of the -12 volt circuit to be adjusted.

3-35. **+12 VOLT CIRCUIT.** The $+12$ volt circuit is similar to the -12 volt circuit in that an integrated circuit is used for voltage regulation and foldback current limiting is used for overload protection. The $+12$ volt circuit, however, uses a center-tapped rectifier to provide the dc voltage. Rectifiers A1CR11 and A1CR12 convert ac voltage from one set of secondary windings on transformer T1 to an unregulated dc supply. The unregulated voltage is applied to pin 3 of A1U2 and the regulated output is applied to pin 8 of A1U2. The booster output at pin 2 of A1U2 is amplified by A1Q8 and two emitter-follower amplifiers, Q9 and Q10 to give the output the desired gain. Resistor A1R54 is used as the sensing device for overload protection, and the combination of A1R54, A1R55, and

A1R56 provide the voltage to pin 1 of A1U2 that will cut off the $+12$ volt supply during an overload condition. A reference feedback voltage to pin 6 of A1U2 is adjustable by variable resistor A1R52 to allow adjustment of the $+12$ volt regulated output.

3-36. **-45 VOLT CIRCUIT.** Full-wave bridge rectifier A1CR6 through A1CR9 converts ac voltage from one set of secondary windings on transformer T1 to provide a -45 volt dc supply at pin U of power supply PCA A1. Current limiting is used to provide overload protection in the circuit. Regulation is provided by utilizing a differential amplifier which compares the -45 volt output with a regulated -12 volt dc reference voltage from the -12 volt circuit. The voltage developed at the junction of A1R25 and A1R26 is applied to the base of A1Q4 and -12 volts is applied through A1R30 to the base of A1Q5, the other half of the differential amplifier. Resistor A1R30 matches the source impedance of each side of the differential amplifier. The output of the differential amplifier at the collector of A1Q5 is amplified by emitter-followers A1Q7 and Q2. The output current of the -45 volt circuit passes through resistor A1R35, which is used as the sensing device for overload protection. When the voltage across A1R35 becomes excessive, the voltage developed at the base of A1Q6 by voltage divider A1R36 and A1R37 turns on A1Q6. The collector voltage of A1Q6 then starts to go in the negative direction, causing A1Q7 to reduce the drive on Q2. Emitter-follower Q2 then begins to turn off, cutting off the -45 volt output until the current through A1R35 is restored to normal.

3-37. **-5 VOLT CIRCUIT.** The -5 volt circuit uses the -12 volt supply as a current source and a zener diode as a shunt voltage regulator. The -5 volt output is applied to pins K and 9 of power supply PCA A1. Load current in the circuit is limited by A1R18 and regulation is provided by breakdown diode A1CR5.

3-38. A $+22.3$ volt dc is developed across resistor A1R58 to enable the brake and clutch in the control circuitry to energize rapidly.

4-1. INTRODUCTION.

4-2. This section contains information and instructions necessary for maintenance, troubleshooting, and repair of the tape reader.

4-3. PREVENTIVE MAINTENANCE.

4-4. The tape reader is designed for a minimum of maintenance. Table 4-1 lists the schedules for periodic inspection, cleaning, and lubrication of the unit.

Table 4-1. Preventive Maintenance Schedule

Routine	Schedule
Inspection (paragraph 4-5)	Monthly
Cleaning (paragraph 4-7)	Weekly
Lubrication (paragraph 4-11)	Quarterly

4-5. INSPECTION.

4-6. The tape reader should be periodically inspected for signs of mechanical and electrical defects. Electronic components that show signs of overheating, leakage, frayed insulation, and other signs of deterioration should be checked and a thorough investigation of the associated circuitry should be made to verify proper operation. Mechanical parts should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

4-7. CLEANING.

4-8. The tape reader should be kept free of dust, moisture, grease and foreign matter to ensure trouble-free operation. A dry, clean cloth, a soft-bristle brush, or a cloth saturated with Freon TF or a similar solvent may be used.

WARNING

This unit has dangerous line voltage present at various points within the chassis. Use extreme caution when working on the unit with the cover removed, or serious injury or death to personnel may result.

4-9. It is especially important that the area around read head be kept clean. Check and clean the glass covering the phototransistors. The plastic-covered wire foot that holds the tape flat against the read head may have to be removed to perform this operation. Accumulated lint around the

read head can cause errors in readout. A soft-bristle brush, a cotton swab, Freon TF, and compressed air can be used to clean the read head.

4-10. The capstan and pinch roller should be cleaned with a cloth saturated with Freon TF or a similar solvent to remove any accumulation of contaminated material and capstan glaze. It may be necessary to use a light abrasive, such as an ink eraser, to remove the capstan glaze.

4-11. LUBRICATION.

4-12. The tape drive motor has an oil wick located on the back end of the motor housing. This should be kept saturated with oil. If wick appears to be drying, oil with 2 or 3 drops of a light (20 weight) machine oil. Wipe all excess oil from the housing with a soft cloth.

Note: If the tape reader is being operated in extreme environmental temperature (hot or cold), the motor may require more frequent oiling than the schedule indicates. When first operating the unit, check the oil wicks frequently to determine a suitable interval for the particular environment.

4-13. All other mechanical parts on the unit are either permanently oiled during manufacture or are of a synthetic material that does not require lubrication.

4-14. ADJUSTMENT PROCEDURES.

4-15. The following paragraphs contain mechanical and electrical adjustment procedures for the tape reader. These procedures should be performed whenever parts are replaced that may affect adjustment or whenever the unit is suspected to be out of adjustment for any reason.

WARNING

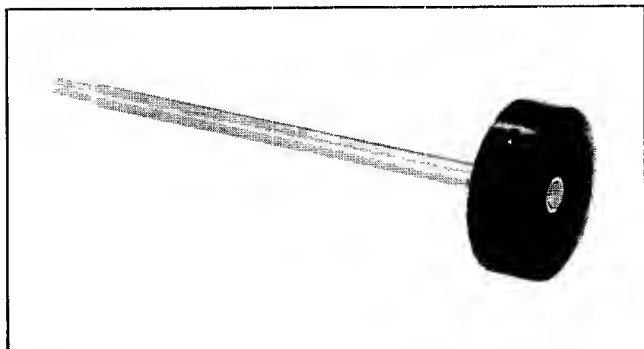
This unit has dangerous line voltage present at various points within the chassis. Use extreme caution when working on the unit with the cover removed, or serious injury or death to personnel may result.

4-16. CLUTCH ADJUSTMENT.

4-17. The clutch should be adjusted any time a new clutch or any part that may affect clutch alignment has been replaced. Failure to properly align and adjust the

clutch will result in early clutch failure. A clutch alignment tool (part no. 02748-2008), is required for proper clutch alignment. The tool is shown in figure 4-1. To adjust the clutch, proceed as follows:

- a. With a feeler gauge, check clutch gap and adjust, if necessary, for a 0.010 ± 0.005 -inch gap. Adjust gap by loosening screw in clutch plate, setting clutch plate on capstan shaft for proper clearance, and tightening screw in clutch plate. (See figure 4-2.)

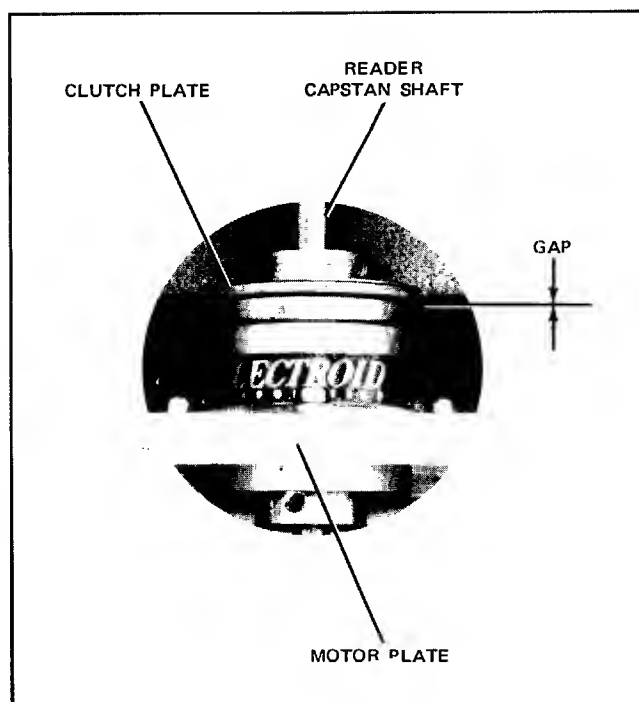


2227-9

Figure 4-1. Clutch Alignment Tool

- b. Press POWER switch on.
- c. Press and hold MANUAL ADVANCE switch and listen for excessive clutch noise. Press MANUAL ADVANCE switch several times to seat clutch in different positions and listen for clutch noise in each position. If excessive noise is present, recheck clutch gap and then proceed to step d; if there is not excessive noise, adjustment procedure is complete.
- d. Remove drive capstan shaft and clutch plate from tape reader.
- e. Slide clutch alignment tool into drive capstan hole. Tool should slide easily into motor-end of clutch assembly without hanging up on clutch hub. If tool does not enter smoothly, loosen the four socket-head cap screws and washers that secure motor plate assembly to bearing carrier and move motor plate as necessary for proper alignment.
- f. Tighten the four socket-head cap screws (without washers). Verify proper alignment with clutch alignment tool. Remove clutch alignment tool.
- g. Remove one socket-head cap screw at a time and replace washers, making certain that each screw is tightened before removing next screw.
- h. Verify proper alignment with clutch alignment tool. If clutch is not properly aligned, repeat steps e through g.
- i. Replace capstan shaft and clutch plate, setting clutch gap for 0.010 ± 0.005 -inch.
- j. Repeat steps b and c.

4-2



2227-10

Figure 4-2. Clutch Adjustment

4-18. PINCH ROLLER ADJUSTMENT.

4-19. The first part of the pinch roller adjustment procedure adjusts the force which the pinch roller exerts against the drive capstan. The last part of the procedure aligns the pinch roller with the drive capstan so that the pinch roller makes contact with the drive capstan along the entire length of the pinch roller. This procedure should be performed whenever parts are replaced that may affect the pinch roller spring tension or alignment, or anytime inspection indicates that adjustment is required. A spring scale with a resolution of 1 ounce is required to make the adjustment. To adjust the pinch roller, proceed as follows:

- a. On tape reader, place POWER switch on and press MANUAL ADVANCE switch. The pinch roller should be engaged against the drive capstan and rotating.
- b. With spring scale, measure the force exerted against the drive capstan by the pinch roller. Accomplish this by lifting the pinch roller away from the drive capstan until the pinch roller stops rotating. Lower the pinch roller against the drive capstan until the drive capstan just begins to rotate. The spring scale should indicate 15 to 17 ounces of force. If specified indication is not present, proceed to step c.
- c. To adjust pinch roller spring tension, remove top cover from the tape reader and bend spring bracket up or down with pliers to increase or decrease tension. Alternately check spring and bend spring bracket until desired results are obtained. If this adjustment does not

have sufficient range, it may be necessary to vertically reposition the pinch roller solenoid. After adjustment, check the solenoid action to ensure that solenoid bottoms out when energized.

- d. Manually activate the pinch roller and observe the contact surfaces between the pinch roller and the drive capstan. They must contact along the entire length of the pinch roller. It is permissible that the back of the pinch roller contact the drive capstan first. This will cause the tape to track properly against the back edge of the read head trough. It is not acceptable to have the front of the pinch roller contact the drive capstan first. If surfaces are mating properly, adjustment is complete. If not, proceed to step e.
- e. Disconnect power from unit. Remove side covers and top extrusion from unit. (Refer to parts location information in section V.)
- f. Loosen both the top and bottom setscrews in the block at the front panel end of the pinch roller arm mounting shaft.
- g. Reconnect power to unit and press POWER switch on.
- h. Manually actuate the pinch roller. If pinch roller makes contact at front end of capstan only, turn bottom setscrew in mounting shaft block in until the two surfaces are making proper contact. If contact is at back of capstan only, turn top setscrew in until contact is made along entire length of pinch roller. After setting pinch roller with one or the other of the two screws, turn the screw not used for the adjustment in until it is tight against the pinch roller mounting shaft and locks the adjustment.
- i. Repeat step h until pinch roller and drive capstan are in contact along entire length of pinch roller.

4-20. POWER SUPPLY PCA A1 ADJUSTMENT.

4-21. The following paragraphs provide a procedure for adjusting the ± 12 volt variable resistors on power supply PCA A1. This procedure should be performed whenever A1 is replaced or whenever parts are replaced that may affect the ± 12 volt output levels. The only equipment necessary to perform this adjustment is an HP 427A Voltmeter, or equivalent. To adjust A1, proceed as follows:

WARNING

This unit has dangerous line voltage present at various points within the chassis. Use extreme caution when working on the unit with the cover removed, or serious injury or death to personnel may result.

- a. Remove top cover from unit.
- b. Extend A1 with PCA extender (part no. 02758-6017).
- c. Press POWER switch on unit on. Press READ switch.
- d. Connect voltmeter between pin B on A1 and chassis.
- e. Adjust variable resistor A1R52 until voltmeter indicates $+12 \pm 0.1$ volts dc.
- f. Connect voltmeter between pin AA on A1 and chassis.
- g. Adjust variable resistor A1R16 until voltmeter indicates -12 ± 0.1 volts dc.

4-22. READ HEAD ASSEMBLY A5 ADJUSTMENT.

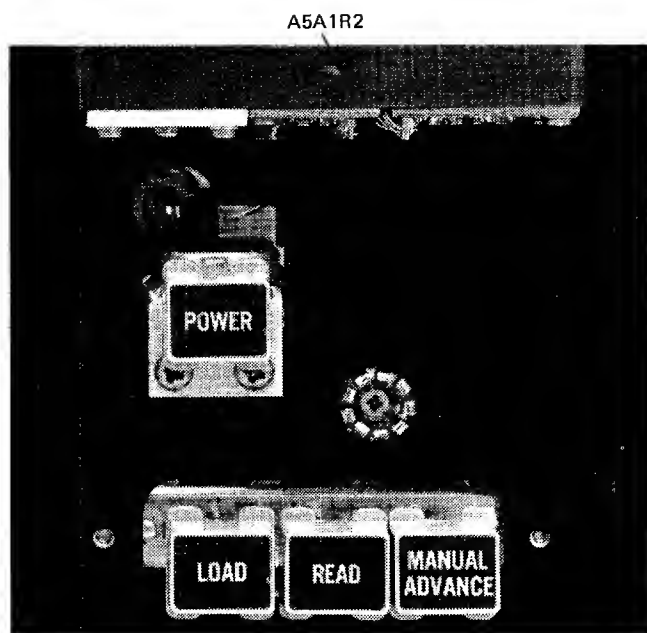
4-23. The following steps provide a procedure for adjusting variable resistors A5A1R2 and A5R13 on read head assembly A5. Variable resistor A5A1R2 determines the threshold level for the read head phototransistors, and A5R13 controls lamp intensity. If any of the following adjustment procedures cannot be carried out due to a unit malfunction, refer to the troubleshooting information in paragraph 4-26.

4-24. The following test equipment (or equivalent) is required for the adjustment procedure:

- a. HP 427A Voltmeter.
- b. HP 180A Oscilloscope.
- c. Tape loop with alternately punched ones and zeros.

4-25. To adjust the read head assembly reference voltage and lamp intensity, proceed as follows:

- a. Set tape reader POWER switch off. Remove control panel from front of unit by pulling control panel straight out from unit front panel. (See figure 5-2.)
- b. Remove Pozidriv screw that secures read head assembly to unit front panel. Pull read head assembly straight out from front panel.
- c. Loosen screw inside read head assembly that secures lamp cover and lift lamp cover off read head. Temporarily reinstall read head assembly by plugging assembly into connector XA5 on unit front panel.
- d. Set A5A1R2 (see figure 4-3) fully clockwise (off-bias threshold) and set A5R13 (figure 5-2, at the top of item 11) fully counterclockwise (maximum lamp intensity). After making certain that lamp assembly is in place in read head assembly, press POWER and READ switches on.
- e. Connect voltmeter to feedhole output (J2-FF) on rear of tape reader and observe voltage reading.



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Figure 4-3. Phototransistor Reference-Voltage Variable Resistor Location

- (1) If voltmeter is at $+12 \pm 0.5$ volts dc (light absent), rotate A5A1R2 counterclockwise just enough to cause the voltage reading to go to $0, +0.5 - 0$, volts dc (light present); then proceed to step f.
- (2) If voltmeter is at $0, +0.5 - 0$, volts dc, momentarily interrupt light path to feedhold phototransistor with a piece of opaque paper. The voltmeter should indicate $+12 \pm 0.5$ volts dc while light path is interrupted. If voltmeter remains at $+12 \pm 0.5$ volts dc after restoring light path, rotate A5A1R2 counterclockwise just enough to cause the voltage reading to go to $0, +5 - 0$, volts dc; then proceed to step f. If voltmeter returns to $0, +0.5 - 0$, volts dc (light too bright) after restoring light path, proceed to sub-step (3) below.
- (3) Turn A5R13 clockwise until voltmeter indicates $+12 \pm 0.5$ volts dc. Turn A5A1R2 counterclockwise just enough to cause the voltage reading to go to $0, +0.5 - 0$, volts dc. Proceed to step f.

Note: The connector pins on A5 are designated A through N (omitting G and I) on the underside of the connector and 1 through 12 on the topside of the connector. The first and last pins are marked on the male connector. Remove the read head and become familiar with the pin numbering system before performing the procedure in step f below.

- f. With voltmeter, measure and record voltage at A5, pin F. The voltage should be at least $+5$ volts dc. If voltage is low, check for dirt or obstruction in light

path, improperly positioned lamp, and a dim lamp. If any corrections to the read head are made, repeat adjustment procedure from step a.

- g. Adjust A5A1R2 until voltage at A5, pin F is approximately two-thirds the value measured in step f. Under this condition, all phototransistors should be able to detect light present.
- h. Measure voltage at connector J2, pins B, F, L, R, V, Z, D and J, to ascertain that all pins indicate that light is detected. The voltage at each pin should be $0, +0.5 - 0$, volts dc. If any output is not at $0, +0.5 - 0$, volts dc, check for dirt or obstruction in light path, improperly positioned lamps, and dim lamps. If any corrections are made, return to step f.
- i. Connect voltmeter to A5, pin F and adjust A5A1R2 until voltmeter indication is approximately one-half of the reading in step f. Under this condition, all phototransistors should be able to detect the absence of light.
- j. To ensure that light remains undetected, obstruct light path to each phototransistor on the read head assembly. The corresponding data or feedhole output on connector J2 should go to $+12 \pm 0.5$ volts dc as the respective light paths are interrupted (J2, pins B, F, L, R, V, Z, d, j, and FF).

Note: The light holes in the read head correspond to the connector pins on J2 as follows (starting from the front of the read head): J2-j, d, Z, V, R, FF, L, F, and B.

- k. Prior to loading tape in read head trough, measure the gap between the tape guide wire and glass cover to ensure that the gap width is between 0.008 and 0.020 inch. Since a metal feeler gauge will not fit into the aperture, make a feeler gauge by folding several layers of paper tape (nominal thickness 0.004 inch). Adjust if necessary by slightly bending the tape guide wire until the specified opening is achieved.
- l. Place a loop of tape punched with alternate ones and zeros in the tape reader. Press MANUAL ADVANCE.

- m. Set oscilloscope controls as follows:

CONTROL	SETTING
SWEEP TIME	.2 MSEC/CM
TRIGGER SLOPE	—
SWEEP MODE	FREE RUN
TRIGGER SOURCE	INT.
HORIZONTAL DISPLAY	X1
CHANNEL A INPUT	DC
CHANNEL A SENSITIVITY	.5 V/CM

Note: When using the oscilloscope to measure waveforms in the following steps, ignore variations caused by the splice in the tape loop.

- n. Connect INPUT of oscilloscope to data output pin J2-B on tape reader. Adjust TRIGGER LEVEL on oscilloscope to obtain a stable trace. Measure width of negative-going pulse (this is the on-time for the data channel). The pulse width should be at least 1.1 milliseconds (1.32 milliseconds with option 001).
- o. Repeat step n for each data channel (J2, pins F, L, R, V, Z, d, and j).
- p. Connect oscilloscope probe to pin J2-FF at set TRIGGER SLOPE on oscilloscope to (-). Measure width of negative-going pulse (this is the feedhole duration). The pulse width should be at least 650 microseconds (780 microseconds with option 001).
- q. Connect oscilloscope TRIG INPUT to data output pin J2-B on tape reader. Set oscilloscope controls as follows:

CONTROL	SETTING
SWEEP TIME	100 MSEC/CM
TRIGGER SLOPE	—
SWEEP MODE	PRESET
TRIGGER SOURCE	EXT. AC
HORIZONTAL DISPLAY	X1
CHANNEL A INPUT	DC
CHANNEL A SENSITIVITY	.5 V/CM

- r. Adjust oscilloscope TRIGGER LEVEL to obtain a stable trace, and connect INPUT of oscilloscope to pin J2-FF on tape reader.
- s. Observe delay from arrival of data to arrival of feedhole signal. Nominal delay is 325 microseconds and minimum delay is 100 microseconds. (See figure 3-2.) (With option 001 nominal delay is 390 microseconds and minimum delay is 120 microseconds.)
- t. Repeat steps p, q and s for each data output (j2-F, L, R, V, Z, d, and j).

Note: If the foregoing read head adjustment procedure cannot be properly completed without difficulty, it may be necessary to replace the read head assembly or alter the final setting of A5A1R2 slightly to optimize the unit performance.

4-26. TROUBLESHOOTING.

4-27. Troubleshooting information for the tape reader consists of a troubleshooting flowchart, checkout procedures, and a logic diagram. When troubleshooting the

tape reader perform steps A through C on the flowchart (figure 4-5) to isolate the problem to a particular assembly. Then, check the assembly by referring to the appropriate checkout procedure referenced on the flowchart. Checkout procedures in the following paragraphs need only be performed when directly referenced by a step on the flowchart.

WARNING

This unit has dangerous line voltage present at various points within the chassis. Use extreme caution when working on the unit with the cover removed, or serious injury or death to personnel may result.

4-28. POWER SUPPLY PCA A1 CHECKOUT.

4-29. Power supply PCA A1 can be checked by monitoring the +12 volts dc, -12 volt dc, -45 volts dc, and -5 volt dc outputs while varying the ac line voltage to ensure that the outputs remain within tolerance. Test equipment required is as follows (or equivalent):

- a. Variable AC Transformer (102 to 128 volts ac output).
- b. HP 427A Voltmeter.
- c. HP 180A Oscilloscope.

4-30. To check A1, proceed as follows:

- a. Remove top cover from unit. Extend A1 with PCA extender.
- b. Adjust variable transformer for 115 volts ac output and connect to ac input of tape reader.
- c. Press POWER switch on.
- d. Press READ switch. Use voltmeter to measure output voltage and oscilloscope to measure ripple of +12 volt circuit as listed in step 1 of table 4-2 while varying line voltage from 102 to 128 volts ac.
- e. Use voltmeter to measure output voltage and oscilloscope to measure ripple of -12 volt circuit as listed in step 2 of table 4-2 while varying line voltage from 102 to 128 volts ac.
- f. Use voltmeter to measure output voltage and oscilloscope to measure ripple of -45 volt circuit as listed in step 3 of table 4-2 while varying line voltage from 102 to 128 volts ac.
- g. Use voltmeter to measure output voltage of -5 volt circuit as listed in step 4 of table 4-2 while varying line voltage from 102 to 128 volts ac.
- h. If A1 or parts on A1 are replaced, perform adjustment procedure described in paragraph 4-20.

Table 4-2. Power Supply PCA A1 Checkout

Step	Measure At A1, Pin	Output Voltage (DC)	Maximum Ripple (MV P-P)	If Indication Is Abnormal
1	B	+12 \pm 0.1	71	Check A1CR11, A1CR12, A1Q8, Q9, Q10, A1U2, and A1R52 if voltage is not within tolerance. Check C23 if maximum allowable ripple is being exceeded. If voltage oscillates, check C22. Refer to voltage readings on schematic diagram, figure 4-10.
2	24	-12 \pm 0.1	71	Check A1CR1 thru A1CR4, A1Q3, Q1, A1U1, and A1R16 if voltage is not within tolerance. Check C5 if maximum allowable ripple is being exceeded. If voltage oscillates, check C6. Refer to voltage readings on schematic diagram, figure 4-10.
3	U	-45 \pm 2	71	Check A1CR6 thru A1CR9, A1Q4 thru A1Q7, and Q2 if voltage is not within tolerance. Check C3 if maximum allowable ripple is being exceeded. If voltage oscillates, check C4. Refer to voltage readings on schematic diagram, figure 4-10.
4	K	-5 \pm 0.5	—	Check A1CR5 and A1R18 if voltage is not within tolerance. Refer to voltage readings on schematic diagram, figure 4-10.

4-31. OPERATIONAL CHECKOUT.

4-32. The operational checkout is performed by applying power to the unit, setting switches and input commands for the desired mode of operation as listed in table 4-3, and verifying that the operating conditions of the tape reader agree with the conditions listed in the second half of table 4-3 for each respective operating mode.

4-33. CONTROL PCA A2 CHECKOUT.

4-34. If control PCA A2 is defective, a malfunction will generally be obvious during the operational check in paragraph 4-31. Malfunctions associated with A2 can be traced to defective components by referring to the logic diagram (figure 4-6) and the schematic diagram (figure 4-9). Trace signal flow through the logic diagram, checking for signals that should be present for a given mode of operation and isolating improper signal interruption to faulty components.

4-35. MECHANICAL CHECKOUT.

4-36. The steps below check several possible sources of mechanical trouble in the tape reader. If the unit is not operating properly and the control circuitry (Control PCA A2) has been checked and found to be functioning properly, the trouble may be traced to one or more of the following mechanical troubles. Replace any parts that are found to be defective. (Refer to removal and replacement procedures, paragraph 4-42.) Perform the mechanical checkout as follows:

- a. Perform preventive maintenance procedures described in paragraph 4-3.
- b. Remove top cover from unit.
- c. Operate unit and listen for excessive bearing or clutch noise. (Refer to paragraph 4-16 for clutch adjustment.)
- d. Check roller surfaces for excessive wear.
- e. Check mating roller surfaces during operation to ensure that there are no gaps in contact area between the two roller surfaces. (Refer to paragraph 4-18 for pinch roller adjustment.)
- f. Check pinch roller tension. (Refer to paragraph 4-18 for pinch roller adjustment.)
- g. Turn rotating parts by hand, with no power applied, to ensure that parts turn freely (no binding).
- h. Check for cracked, broken, or loose parts and any signs of unusual wear or corrosion.
- i. Check tape guide wire on read head assembly A5 for proper adjustment. (Refer to paragraph 4-25, step k.)
- j. Check tape tracking in continuous and start/stop modes. Tape should smoothly traverse read head with edge of tape tracking against the back edge of the trough. A large roll of tape may cause tape to wander away from the back edge of the trough. Under no conditions can tape be allowed to bounce off the front edge of read head trough.

Table 4-3. Operational Chart

Mode of Operation		Operating Conditions			
Switch Selected	Input Command (J2-AA)	Paper Brake	Reader Capstan Driven	Reader Pinch Roller	Feedhole Output (J2-FF)
None	—	On	No	Engaged	Inhibited
LOAD	—	Off	No	Released	Inhibited
READ	READ	Off	Yes	Engaged	Enabled
	READ	On	No	Engaged	Enabled
MANUAL ADVANCE	—	Off	Yes	Engaged	Inhibited
NOTE: <u>READ</u> indicates that a read command is present. READ indicates the absence of a read command.					

4-37. READ HEAD ASSEMBLY A5 AND INTERFACE PCA A3 CHECKOUT.

Note: If read head assembly A5 is found to be defective during troubleshooting, the complete assembly may be replaced by a rebuilt assembly on an exchange basis by contacting a Hewlett-Packard Sales and Service Office.

4-38. Read head assembly A5 and interface PCA A3 may be checked by energizing the unit and interrupting the light path to the phototransistors on A5 while monitoring the output for each data channel at connector J2. In this manner, a malfunction may be isolated to a specific channel and components for the respective channel can then be checked. While performing this checkout procedure, refer to the logic diagram for the unit, figure 4-6. The only test equipment required is an HP 427A Voltmeter, or equivalent. To check A5 and A3, proceed as follows:

- Press LOAD switch. Press POWER switch on. All lamps on read head assembly A5 should light with approximately equal intensity.
- With voltmeter, measure voltage levels at pins of rear connector J2 with light path to phototransistors obstructed and then unobstructed as indicated in table 4-4.

Note: If a single phototransistor on A5A2 is defective, the complete read head assembly (A5) must be replaced.

- Press READ switch. With voltmeter, measure voltage levels at pin FF of connector J2 with light path to phototransistors obstructed and then unobstructed. Open reading should be 0, +0.5 -0, volts dc; closed reading should be +12 ±0.5 volts dc. If indication is abnormal, check A3Q10, A3Q11, A3Q12 and A3Q13.

Table 4-4. Read Head Assembly A5 and Interface PCA A3 Checkout

Measure at Connector J2 Pin	Light Path to Phototransistors	Normal Indication (VDC)	If Indication is Abnormal
B	Clear	0, +0.5 -0	Check A3Q1.
	Blocked	+12 ± 0.5	
F	Clear	0, +0.5 -0	Check A3Q2.
	Blocked	+12 ± 0.5	
L	Clear	0, +0.5 -0	Check A3Q3.
	Blocked	+12 ± 0.5	
R	Clear	0, +0.5 -0	Check A3Q4.
	Blocked	+12 ± 0.5	
V	Clear	0, +0.5 -0	Check A3Q5.
	Blocked	+12 ± 0.5	
Z	Clear	0, +0.5 -0	Check A3Q6.
	Blocked	+12 ± 0.5	
d	Clear	0, +0.5 -0	Check A3Q7.
	Blocked	+12 ± 0.5	
j	Clear	0, +0.5 -0	Check A3Q8.
	Blocked	+12 ± 0.5	

- With a jumper wire, apply chassis potential to pin J2-AA. Use voltmeter to measure voltage at pin Z of A3. Voltmeter should indicate +12 ±0.5 volts dc. Remove chassis connection at pin J2-AA. Voltmeter should now indicate 0, +0.5 -0, volts dc. If indication is abnormal, check A3Q9.

4-39. PUNCHED TAPE CHECKOUT.

4-40. The tape reader performs satisfactorily with a wide variety of punched tapes. However, tape transmissivity must be less than 60 percent and the tape must also be punched within the tolerances shown in figure 4-4. Tape tolerances can easily be checked accurately by using tape registration template (part no. 1535-0268). This template measures the longitudinal and lateral registration of the tape.

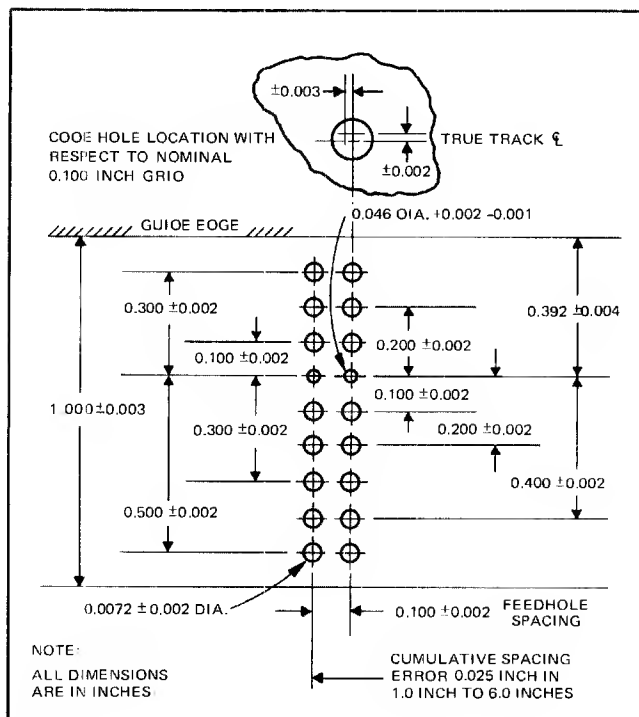


Figure 4-4. Punched Tape Specifications

4-41. The condition of the tape can cause serious difficulty in the operation of the unit. Some of the more common tape reader malfunctions can often be traced to the condition of the punched tape being read, especially if errors in readout are being obtained. Faulty conditions to look for when checking tape are as follows:

- a. **Pulled Sprocket Holes:** Some takes have an occasional elongated sprocket hole. This is usually caused by a maladjusted tape punch or an incorrectly loaded supply reel on the punch. If the sprocket holes arrive too soon because of this, the data holes may be completely ignored by the tape reader.

- b. **Chad in Tape:** Chad fits tightly in tape holes and may cause misreading of the tape. Tape should never be fed from a chad box.
- c. **Lint on Tape:** Lint on a tape can accumulate under the tape reader lamp and block off the light. Tapes and their containers should be kept clean.
- d. **Ragged Edges:** A code hole that has been torn, leaving ragged edges, will normally be read correctly. But the bit of paper that folds back and covers the next hole may cause the following character to be misread.
- e. **Oil Spots:** Normal oil-impregnated tapes should not affect unit operation, but oil from other sources can. Lubricating oil may even bleach the color from the tape. Oil contamination is usually the result of allowing tape to stand for long periods in the head or tape holder of a tape punch.
- f. **Light Spots:** Light spots are imperfections in the paper created during paper pulp processing.
- g. **Static:** Tape containing a static charge will cause errors in readout by either inducing electrical noise, or by contaminating the read head area from dirt deposited by the tape. Static can be eliminated by humidifying the operating and storage environment, or by treating the tape with an antistatic spray.

4-42. REMOVAL AND REPLACEMENT.

4-43. When disassembling the tape reader to replace parts, refer to the parts location diagrams in section V of this manual. Remove parts in accordance with the appropriate portion of the exploded view and replace in the reverse order of disassembly. Refer to the index numbers for order of disassembly.

4-44. ILLUSTRATIONS.

4-45. The following illustrations include a logic diagram, schematic diagrams, printed-circuit assembly parts location drawings, and wiring terminal location diagram for the tape reader. Parts lists for each PCA are located adjacent to the respective schematic diagram. Also included in section IV is Table 4-8 the Point-to-Point Wiring List.

Table 4-5. Interface PCA A3 (02748-60035), Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3	02748-60035	1	INTERFACE PCA	50438	02748-60035
A3C1	0160-2204	10	C:FXD MICA 100PF 5%	T2136	ROM15F101J3C
A3C2	0160-0300	1	C:FXD MY 0.0027 UF 200VOCW	56289	192P27292-PTS
A3C3	0140-0200	6	C:FXD MICA 390 PF 5%	T2136	ROM15F391-J3C
A3C4	0160-2204		C:FXD MICA 100PF 5%	T2136	ROM15F101J3C
A3C5	0160-2204		C:FXD MICA 100PF 5%	72136	ROM15F101J3C
A3C6	0140-0208	1	C:FXD MICA 680 PF 5%	T2136	ROM15F681J3C
A3C7	0180-0100	1	C:FXD ELECT 4.7 UF 10% 35VOCW	56289	1500475X9035B2-OYS
A3C11	0160-2204		C:FXD MICA 100PF 5%	T2136	ROM15F101J3C
A3C21	0160-2204		C:FXD MICA 100PF 5%	T2136	ROM15F101J3C
A3C31	0160-2204		C:FXD MICA 100PF 5%	72136	ROM15F101J3C
A3C41	0160-2204		C:FXD MICA 100PF 5%	T2136	ROM15F101J3C
A3C51	0160-2204		C:FXD MICA 100PF 5%	T2136	ROM15F101J3C
A3C61	0160-2204		C:FXD MICA 100PF 5%	72136	ROM15F101J3C
A3C71	0160-2204		C:FXD MICA 100PF 5%	72136	ROM15F101J3C
A3CR1	1901-0081	23	DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR2	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR11	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR12	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR21	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR22	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR31	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR32	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR41	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR42	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR51	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR52	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR61	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR62	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR71	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR72	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR81	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR82	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR91	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR92	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR93	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR94	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3CR95	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A3Q1			THRU		
A3Q19	1854-0071	19	TSTR:SI NPNSELECTED FROM 2N3704)	28480	1854-0071
A3R1	0698-3136	12	R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R2	0698-3156	13	R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R3	0757-0465	13	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R6	0683-1035	11	R:FXD COMP 10K OHM 5% 1/4W	01121	C8 1035
A3R11	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R12	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R13	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R16	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	C8 1035
A3R21	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R22	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R23	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R26	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	C8 1035
A3R31	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R32	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R33	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R36	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	C8 1035
A3R41	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R42	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R43	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R46	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	C8 1035
A3R51	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R52	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R53	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R56	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	C8 1035
A3R61	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R62	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R63	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R66	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	C8 1035
A3R71	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R72	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R73	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R76	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	C8 1035
A3R80	0757-0338	1	R:FXD MET FLM 1.00K OHM 1% 1/4W	28480	0757-0338
A3R81	0757-0438	2	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A3R83	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438

See introduction to section V for ordering information

Table 4-5. Interface PCA A3 (02748-60035), Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3R85	0757-0465	1	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R90	0698-0083	2	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A3R91	0757-0280	2	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R92	0757-0317	1	R:FXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A3R93	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R94	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R95	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	C8 1035
A3R96	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R97	0698-3444	1	R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A3R98	0757-0428	1	R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A3R99	0698-3152	1	R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A3R100	0698-3159	1	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A3R102	0757-0470	1	R:FXD MET FLM 162K OHM 1% 1/8W	28480	0757-0470
A3R103	0698-3266	1	R:FXD MET FLM 237K OHM 1% 1/8W	28480	0698-3266
A3R104	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R105	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A3R106	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R107	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	C8 1035
A3R108	0757-0460	2	R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A3R109	0757-0446	2	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R110	0757-0443	1	R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A3R111	0757-0460		R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A3R112	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R113	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	C8 1035
A3R114	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R115	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R116	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R117	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R118	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R119	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R120	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R121	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R122	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136

See introduction to section V for ordering information

Table 4-6. Control PCA A2 (02748-60034), Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2	02748-60034	1	CONTROL PCA	50438	02748-60034
A2C1	0180-0089	2	C:FXO AL ELECT 10 UF +50-10% 150VDCW	56289	30D106F150D02-DSH
A2C2	0180-0089		C:FXD AL ELECT 10 UF +50-10% 150VDCW	56289	30D106F150D02-DSH
A2C3	0160-0167	1	C:FXD MY .082 UF 10% 200VDCW	56289	192P82392-PTS
A2C4	0160-2198	2	C:FXD MICA 20 PF 5%	72136	ROM15C200J3C
A2C5	0160-2198		C:FXD MICA 20 PF 5%	72136	ROM15C200J3C
A2C6	0180-0229	1	C:FXO ELECT 33 UF 10% 10VDCW	28480	0180-0229
A2CR1	1901-0049	1	D10DE:SiLiCON 50P1V	28480	1901-0049
A2CR2	1901-0081	15	D10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR3	1901-0081		O10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR4	1901-0081		D10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR5	1901-0081		O10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR7	1901-0416		O10DE:SiLiCON 200P1V 3A	28480	1901-0416
A2CR8	1901-0416		O10DE:SiLiCON 200P1V 3A	28480	1901-0416
A2CR9	1901-0416		D10DE:SiLiCON 200P1V 3A	28480	1901-0416
A2CR10	1901-0416		D10DE:SiLiCON 200P1V 3A	28480	1901-0416
A2CR11	1901-0081		O10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR12	1901-0081		D10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR13	1901-0081		O10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR14	1901-0081		O10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR15	1901-0081		D10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR16	1901-0081		O10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR17	1901-0081		D10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR18	1901-0081		O10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR19	1901-0081		D10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR20	1901-0081		D10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A2CR21	1901-0081		O10DE:SiLiCON 50 VOLTS WORKING	07263	F01415
A201	1854-0071	11	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A202	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A203	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A204	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A205	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A206	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A207	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A208	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A209	1854-0246	2	TSTR:SI NPN	80131	2N3643
A2010	1854-0246		TSTR:SI NPN	80131	2N3643
A2011	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2012	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2013	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2R1	0757-0443	8	R:FXO MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A2R2	0757-0446	7	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A2R3	0757-0460	7	R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A2R4	0757-0443		R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A2R5	0757-0446		R:FXO MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A2R6	0757-0460		R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A2R7	0760-0024	1	R:FXO MET QX 100 OHM 5% 1W	28480	0760-0024
A2R8	0698-3458	1	R:FXD MET FLM 348K OHM 1% 1/8W	28480	0698-3458
A2R9	0698-3162	1	R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A2R10	0757-0439	2	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A2R11	0757-0458	4	R:FXO MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A2R12	0757-0465	1	R:FXO MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A2R13	0757-0443		R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A2R14	0757-0446		R:FXO MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A2R15	0757-0460		R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A2R16	0757-0443		R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A2R17	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A2R18	0757-0460		R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A2R19	0764-0013	2	R:FXO MET QX 56 OHM 5% 2W	28480	0764-0013
A2R20	0764-0013		R:FXD MET QX 56 OHM 5% 2W	28480	0764-0013
A2R21	0698-3156	1	R:FXO MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A2R22	0757-0438	1	R:FXO MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A2R23	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A2R24	0698-3404	2	R:FXO MET FLM 383 OHM 1% 1/2W	28480	0698-3404
A2R25	0698-3404		R:FXO MET FLM 383 OHM 1% 1/2W	28480	0698-3404
A2R26	0757-0458		R:FXO MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A2R27	0757-0443		R:FXO MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A2R28	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A2R29	0757-0460		R:FXO MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A2R30	0757-0280	1	R:FXO MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A2R31	0757-0439		R:FXO MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A2R32	0757-0731	1	R:FXO MET FLM 825 OHM 1% 1/4W	28480	0757-0731
A2R33	0757-0443		R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A2R34	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A2R35	0757-0460		R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460

See introduction to section V for ordering information

Table 4-6. Control PCA A2 (02748-60034), Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2R36	0757-0460	1	R:FX0 MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A2R37	0757-0443		R:FX0 MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A2R38	0757-0446		R:FX0 MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A2R39	0757-0443		R:FX0 MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A2R40	0698-3136		R:FX0 MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A2R41	0757-0458		R:FX0 MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458

See Introduction to section V for ordering information

Table 4-7. Power Supply PCA A1 (02758-6004), Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	02758-6004	1	POWER SUPPLY PCA	28480	02758-6004
A1C10	0160-2307	2	C:FXO MICA 47 PF 5%	28480	0160-2307
A1C11	0180-0291	2	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A1C12	0160-2055	1	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A1C20	0160-2307		C:FXO MICA 47 PF 5%	28480	0160-2307
A1C21	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A1CR1	1901-0200	10	DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR2	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR3	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR4	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR5	1902-0041	1	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR6	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR7	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR8	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR9	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR10	1901-0081	1	DIODE:SILICON 50 VOLTS WORKING	07263	F01415
A1CR11	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR12	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1Q3	1853-0041	2	TSTR:SI PNP	02735	38640
A1Q4	1854-0071	4	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q8	1853-0041		TSTR:SI PNP	02735	38640
A1R10	0698-3358	2	R:FXD MET FLM 1K OHM 0.5% 1/8W	28480	0698-3358
A1R11	0757-0394	2	R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A1R12	0811-1674	2	R:FXD WW 4.7 OHM 5% 2W	28480	0811-1674
A1R13	0757-0395	2	R:FXD MET FLM 56.2 OHM 1% 1/8W	28480	0757-0395
A1R14	0757-0815	2	R:FXD MET FLM 562 OHM 1% 1/2W	28480	0757-0815
A1R15	0757-0447	3	R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A1R16	2100-1758	2	R:VAR WW 1K OHM 5% TYPE V 1W	28480	2100-1758
A1R17	0698-0085	2	R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A1R18	0698-3402	1	R:FXD MET FLM 316 OHM 1% 1/2W	28480	0698-3402
A1R25	0757-0452	1	R:FXD MET FLM 27.4K OHM 1% 1/8W	28480	0757-0452
A1R26	0757-0442	1	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R27	0698-3438	2	R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A1R28	0757-0752	1	R:FXD MET FLM 8.25K OHM 1% 1/4W	28480	0757-0752
A1R29	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A1R30	0757-0440	1	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A1R35	0811-1674		R:FXD WW 4.7 OHM 5% 2W	28480	0811-1674
A1R36	0698-3358		R:FXD MET FLM 1K OHM 0.5% 1/8W	28480	0698-3358
A1R37	0757-0447		R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A1R38	0757-0816	1	R:FXD MET FLM 681 OHM 1% 1/2W	28480	0757-0816
A1R39	0757-0438	1	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1R40	0757-1090	1	R:FXD MET FLM 261 OHM 1% 1/2W	28480	0757-1090
A1R51	0698-0085		R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A1R52	2100-1758		R:VAR WW 1K OHM 5% TYPE V 1W	28480	2100-1758
A1R53	0757-0447		R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A1R54	0813-0038	1	R:FXD WW 0.5 OHM 10% 5W	28480	0813-0038
A1R55	0757-0395		R:FXD MET FLM 56.2 OHM 1% 1/8W	28480	0757-0395
A1R56	0757-0815		R:FXD MET FLM 562 OHM 1% 1/2W	28480	0757-0815
A1R57	0698-3446	1	R:FXD MET FLM 383 OHM 1% 1/8W	28480	0698-3446
A1R58	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A1R59	0757-0398	1	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A1R70	0698-3629	1	R:FXD MET 0X 270 OHM 5% 2W	28480	0698-3629
A1U1	1820-0123	2	INTEGRATED CIRCUIT:VOLTAGE REGULATOR	12040	LH300
A1U2	1820-0123		INTEGRATED CIRCUIT:VOLTAGE REGULATOR	12040	LH300

See introduction to section V for ordering information

Table 4-8. Tape Reader Point-to-Point Wiring List

From	To	Color		From	To	Color
B1	T1-2	blu		F1-1	J1-1	wht-blk-gra
B1	T1-4	blu		F1-2	FL1-2	wht-brn-gra
B2	TB1-9	gra				
B2	TB1-10	wht-gra		FL1-1	J1-3	wht-gra
C3-	C4-	vio		FL1-2	F1-2	wht-brn-gra
C3+	XQ2-C	wht-yel		FL1-3	TB1-10	wht-gra
				FL1-3	T1-3	wht-gra
				FL1-4	S1-1	wht-brn-gra
C4-	C3-	vio				
	XA5-9	vio		J1-1	FL1-1	wht-gra
	XA1-M	vio		J1-2	F1-1	wht-blk-gra
	XA1-N	vio		J1-3	C22-	GND LUG
	XA1-U	vio				
C4+	C6+	blk		J2-d	XA3-5	wht-blu
	XA1-14	blk		J2-j	XA3-V	wht-blk-brn
	XA1-P	blk		J2-B	XA3-1	wht-blk
	XA5-10	blk		J2-C	XA3-20	wht-orn-yel
C5-	C6-	wht-vio		J2-F	XA3-3	wht-brn-vio
C5+	XQ1-C	wht-yel-grn		J2-H	XA3-22	wht-red-blu
				J2-L	XA3-5	yel
C6-	C5-	wht-vio		J2-M	XA3-P	wht-blk-vio
	XA1-24	wht-vio		J2-R	XA3-7	blk
	XA1-Y	wht-vio		J2-S	XA3-21	wht-red-grn
	XA1-AA	wht-vio		J2-V	XA3-9	wht-yel
	XA2-21	wht-vio		J2-Z	XA3-12	wht-grn
	XA3-17	wht-vio		J2-AA	XA3-AA	wht-blk-blu
				J2-FF	XA3-X	wht-blk-orn
C6+	XA1-3	blk		J2-HH	XA3-M	blk
	XA1-19	blk				
	XA1-BB	blk		K1-	TB1-7	wht-red
	S2-C	blk		K1-	TB1-8	red
	C4+	blk				
	XA2-7	blk		K4-	TB1-5	wht-orn-blu
	C22-	blk		K4-	TB1-6	blk
C22-	GND LUG					
	J1-2	blk		L1-1	R76 Top	red
	C23-	blk		L1-2	R72 Top	wht-orn-blk
	C6+	blk				
	XA1-H	blk		R72 Bottom	XA2-F	wht-orn
	XA3-11	blk		R72 Top	L1-2	wht-orn-blu
	XQ25-E	blk		R72 Top	TB1-5	wht-orn-blu
C22+	XA1-2	red				
	XA1-J	red		R76 Bottom	C23+	yel
	XA2-Z	red		R76 Top	L1-1	red
	XA3-R	red				
	TB1-8	red		S1-1	FL1-4	wht-brn-gra
				S1-2	T1-1	gra
				S1-2	TB1-9	gra
C23-	C22-	blk				
	T1-10	blk		S2-A1	XA2-U	wht-red
				S2-A1	TB1-7	wht-red
C23+	XQ9-C	yel		S2-A2	S2-B2, C6+	blk
	R76 Bottom	yel		S2-B1	XA2-P	wht-brn-red
				S2-B1	XA2-T	wht-blk-blu
CR7-CATH	XA2-8	om		S2-B2	S2-A2, C6+	blk
CR7-AD	XQ24-E	blk		S2-B2	S2-C2, C6+	blk

Table 4-8. Tape Reader Point-to-Point Wiring List (Continued)

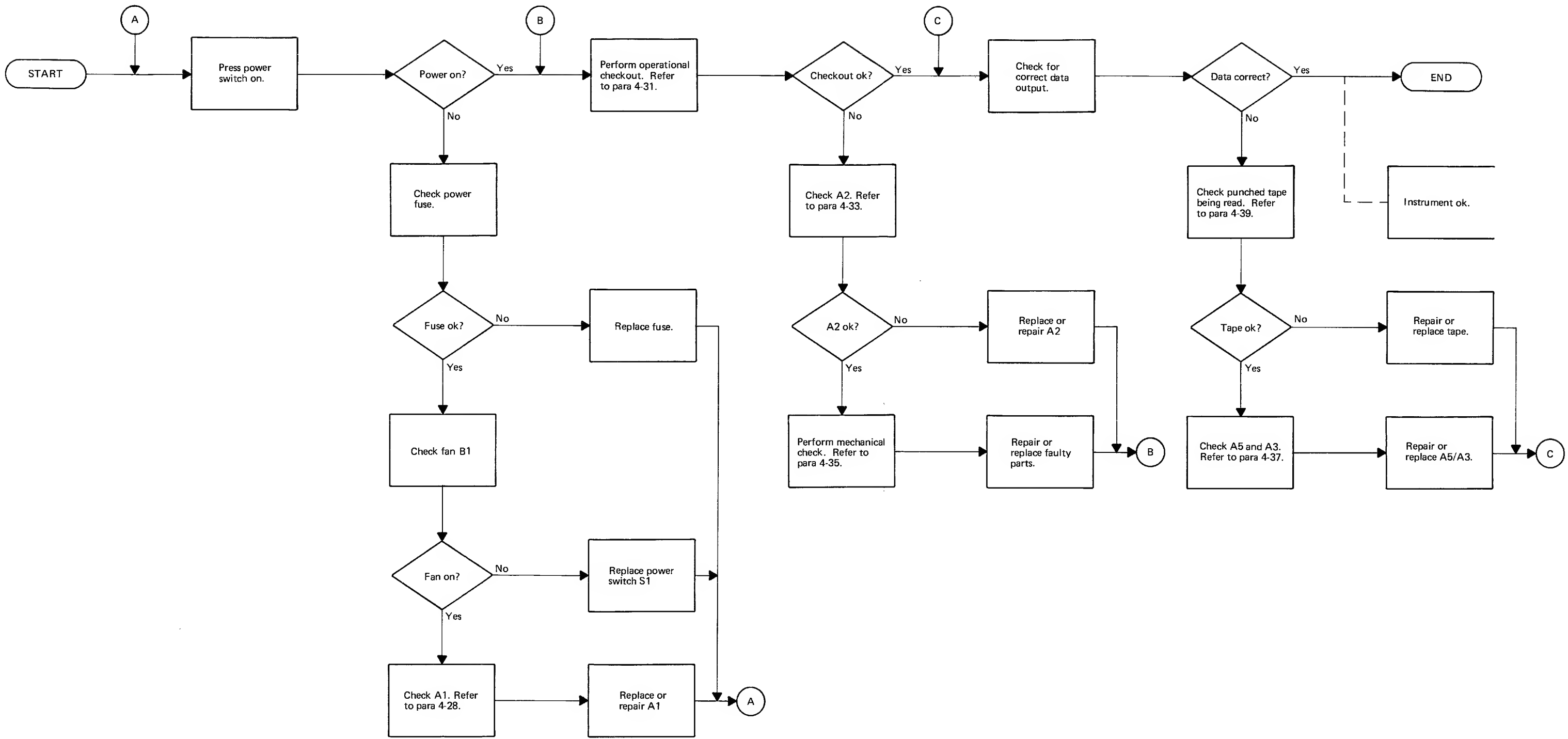
From	To	Color	From	To	Color
S2-C1	XA2-L	wht-yel-grn	XA1-3	XA1-10	blk
S2-C2	S2-B2, C6+	blk	XA1-5	XQ10-B	wht-blk-grn
T1-1*	S1-2	gra	XA1-6	XQ10-E	grn
T1-2*	B1	blu	XA1-13	XQ2-B	wht
T1-3*	FL1-3	wht-gra	XA1-14	C4+	blk
T1-4*	B1	blu	XA1-19	C6+	blk
T1-5	XA1-T	wht-grn	XA1-20	XQ1-B	wht-blk
T1-6	XA1-V	wht-blu	XA1-21	XQ1-E	wht-red
T1-7	XA1-Z	wht-blk-brn	XA1-24	C6-	wht-vio
T1-8	XA1-X	wht-blk-gra	XA2-F	R72 Bottom	wht-orn
T1-9	XA1-F	wht-yel-blu	XA2-H,7	C6+	blk
T1-10	C23-	blk	XA2-J	XQ24-C	wht-orn-yel
T1-11	XA1-C	wht-yel-grn	XA2-L	S2-C1	wht-yel-grn
TB1-5	R72 Top	wht-orn-blu	XA2-N	XA3-24	wht-blk-grn
TB1-5	XA5-N	wht-orn-blu	XA2-P	S2-B1	wht-brn-red
TB1-5	K4	red	XA2-P	XA3-23	wht-blk-blu
TB1-6	XA2-13	blu	XA2-R	XA3-BB	wht
TB1-6	K4	red	XA2-T	S2-B1	wht-blk-blu
TB1-6	XA2-13	blu	XA2-U	S2-A1	wht-red
TB1-7	K1	blk	XA2-Y,21	C6-	wht-vio
TB1-7	S2-A1	wht-red	XA2-Z,22	C22+	red
TB1-8	K1	blk	XA2-AA	XQ25-B	wht-brn-blu
TB1-8	C22+	red	XA2-8	CR1 CATH	orn
TB1-9	B2	blk	XA2-10	XQ25-C	wht-orn-gra
TB1-9	S1-2	gra	XA2-13	TB1-6	blu
TB1-10	B2	blk	XA2-16	A5-M	yel
TB1-10	FL1-3	wht-gra	XA2-20	XA3-Z	wht-red
			XA2-24	XQ24-B	wht-brn-yel
XA1-A,1	XQ9-E	brn	XA3-M,11	J2-H	blk
XA1-B,2	C22+	red	XA3-M,11	C22-	blk
XA1-C	T1-11	wht-yel-grn	XA3-M,11	XA5-8	blk
XA1-D,4	XQ10-C	yel	XA3-P	J2-M	wht-blk-vio
XA1-F	T1-9	wht-yel-blu	XA3-R,14	C22+	red
XA1-H	C22-	blk	XA3-R,14	XA5-H	red
XA1-J	C22+	red	XA3-S	J2-d	wht-blu
XA1-K,9	XA5-J	wht-orn-vio	XA3-T	XA5-4	wht-gra
XA1-L,10	XA1-3	blk	XA3-U,17	C6-	wht-vio
XA1-M	C4-	vio	XA3-V	J2-j	wht-blk-brn
XA1-N	C4-	vio	XA3-W	XA5-A	wht-blk-red
XA1-P	C4+	blk	XA3-X	J2-FF	wht-blk-orn
XA1-R	XQ2-E	wht-blk-orn	XA3-Y	XA5-K	wht-blk-yel
XA1-S	XQ2-C	wht-yel	XA3-Z	XA2-20	wht-red
XA1-T	T1-5	wht-grn	XA3-AA	J2-AA	wht-blk-blu
XA1-U	C4-	vio	XA3-BB	XA2-R	wht
XA1-V	T1-6	wht-blu	XA3-1	J2-B	wht-blk
XA1-W	XQ1-C	wht-yel-grn	XA3-2	XA5-7	wht-orn-gra
XA1-X	T1-8	wht-blk-gra	XA3-3	J2-F	wht-brn-vio
XA1-Y	C6-	wht-vio	XA3-4	XA5-3	orn
XA1-Z	T1-7	wht-blk-brn	XA3-5	J2-L	yel
XA1-AA	C6-	wht-vio	XA3-6	XA5-6	grn
XA1-BB	C6+	blk	XA3-7	J2-R	blu
XA1-3	C6+	blk	XA3-8	XA5-C	wht-blk-grn

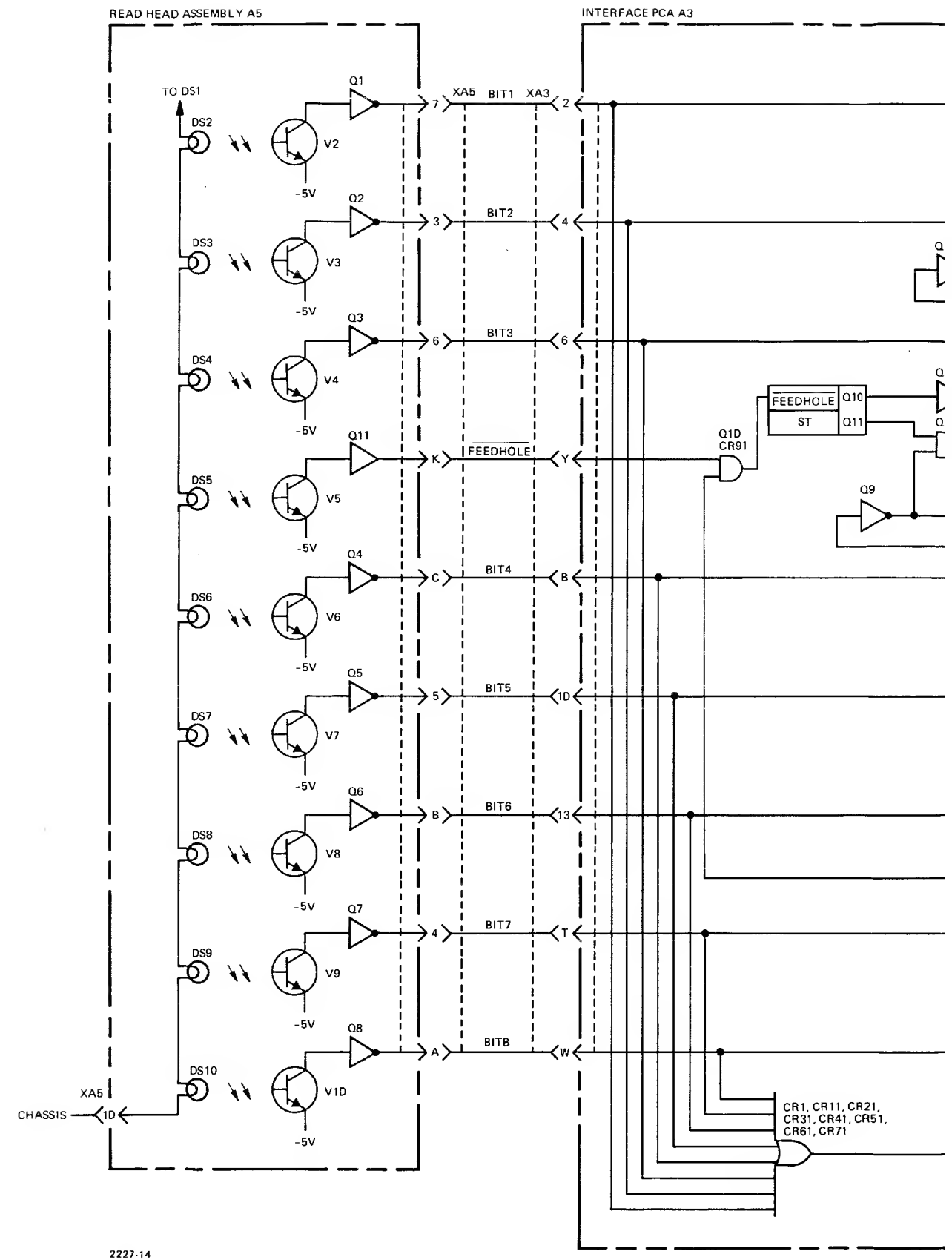
*T1-2, T3-4 jumpered together for standard model.

T2-3 jumpered together for option 001.

Table 4-8. Tape Reader Point-to-Point Wiring List (Continued)

From	To	Color		From	To	Color
XA3-9	J2-V	wht-yel		XQ1-C	C5+	wht-yel-grn
XA3-10	XA5-5	gra		XQ1-C	XA1-W	wht-yel-grn
XA3-12	J2-Z	wht-grn				
XA3-13	XA5-B	wht-blk-orn		XQ2-E	XA1-R	wht-blk-orn
XA3-20	J2-C	wht-orn-yel		XQ2-B	XA1-13	wht
XA3-21	J2-S	wht-red-gra		XQ2-C	XA1-S	wht-yel
XA3-22	J2-H	wht-red-blu		XQ2-C	C3+	wht-yel
XA3-23	XA2-P	wht-blk-blu				
XA3-24	XA2-N	wht-blk-grn		XQ9-E	XA1-1	brn
				XQ9-B	XQ-10E	grn
XA5-A	XA3-W	wht-blk-red		XQ9-C	C23+	yel
XA5-B	XA3-13	wht-blk-orn		XQ9-C	XQ10-C	yel
XA5-C	XA3-8	wht-blk-grn				
XA5-H	XA3-14	red		XQ10-E	XA1-6	grn
XA5-J	XA1-K	wht-orn-vio		XQ10-E	XQ9-B	grn
XA5-K	XA3-Y	wht-blk-yel		XQ10-B	XA1-5	wht-blk-grn
XA5-M	XA2-16	yel		XQ10-C	XQ9-C	yel
XA5-N	TB1-5	wht-orn-blu		XQ10-C	XA1-4	yel
XA5-3	XA3-4	orn				
XA5-4	XA3-T	wht-gra				
XA5-5	XA3-10	gra		XQ24-E	CR71 ANODE	blk
XA5-6	XA3-6	grn		XQ24-E	XQ25-E	blk
XA5-7	XA3-2	wht-orn-gra		XQ24-B	XA2-24	wht-brn-yel
XA5-8	XA3-11	blk		XQ24-C	XA2-J	wht-orn-yel
XA5-9	C4-	vio				
XA5-10	C4+	blk		XQ25-E	C22-	blk
				XQ25-E	XQ24-E	blk
XQ1-E	XA1-21	wht-red		XQ25-B	XA2-AA	wht-brn-blu
XQ1-13	XA1-20	wht-blk		XQ25-C	XA2-10	wht-orn-gra





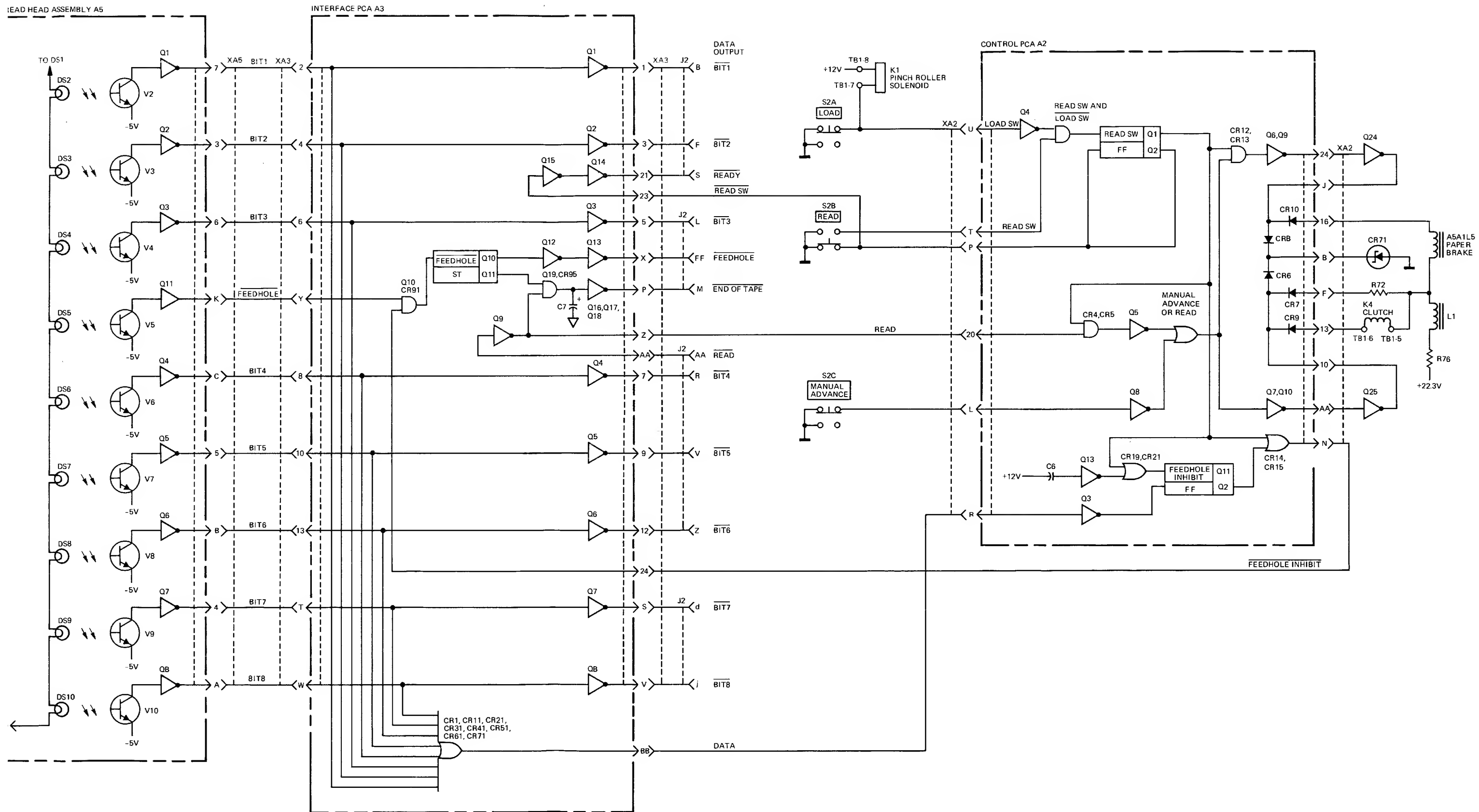
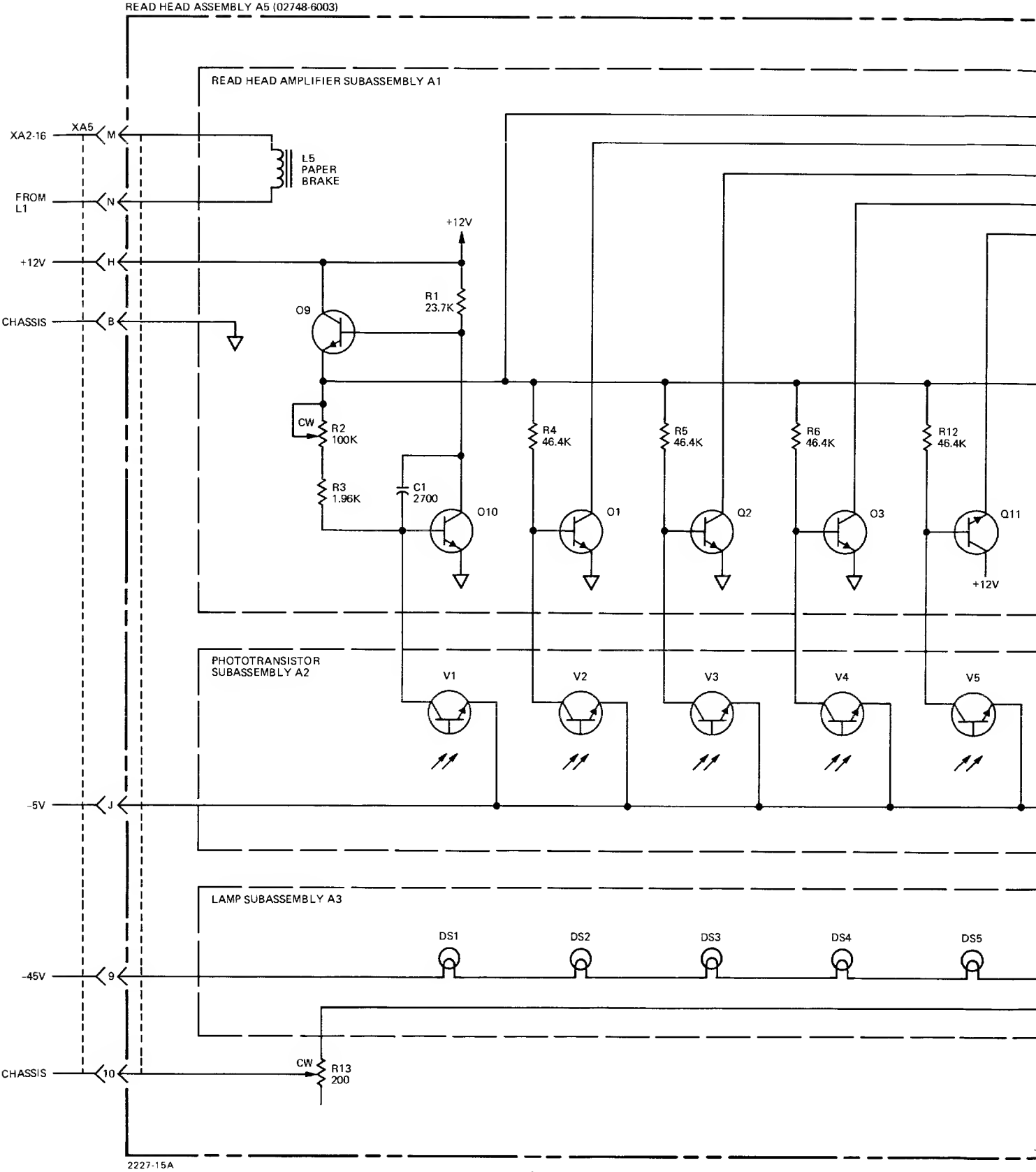


Figure 4-6. Tape Reader Logic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED, RESISTANCE
VALUES ARE IN OHMS. CAPACITANCE VALUES
ARE IN PICOFARADS.

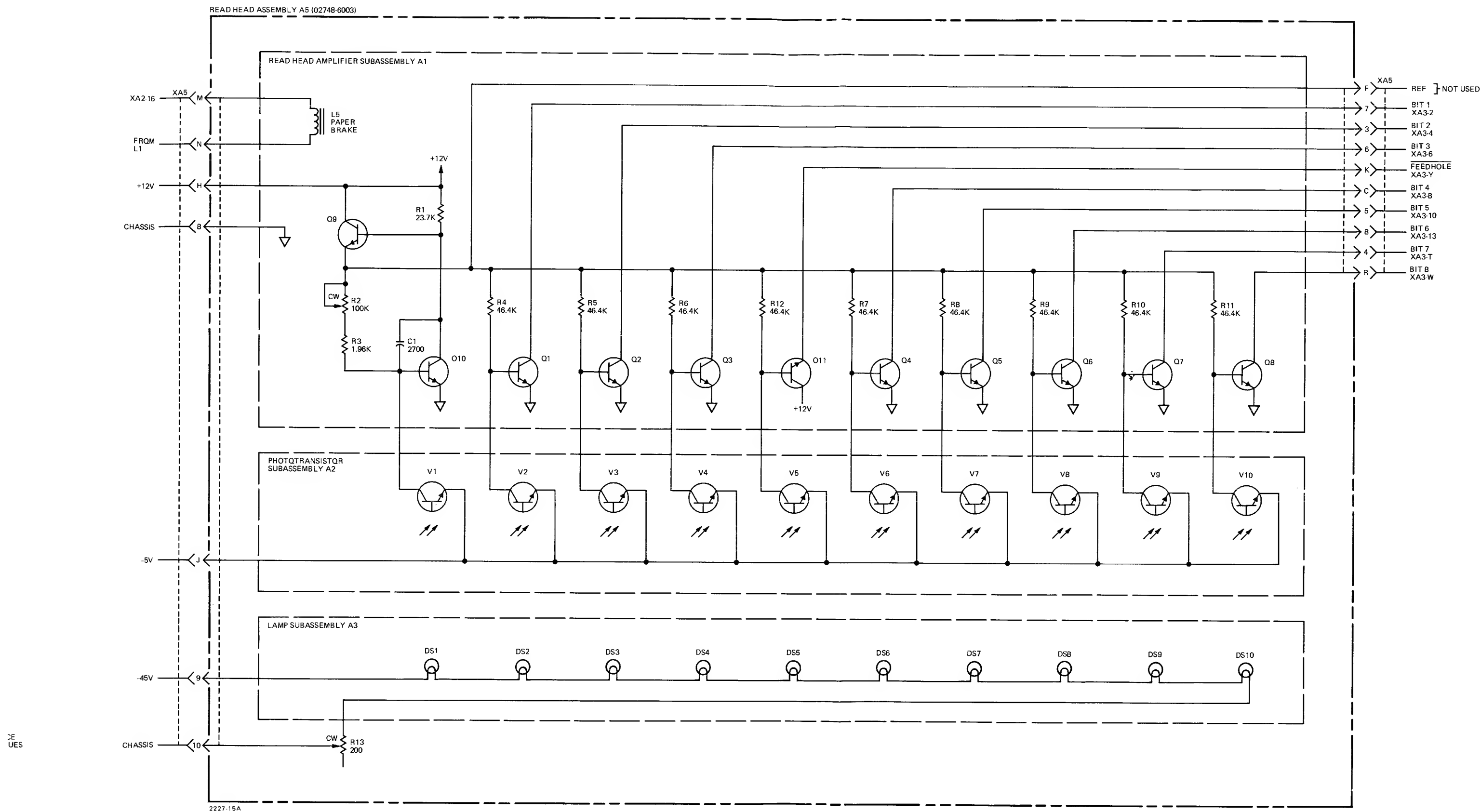
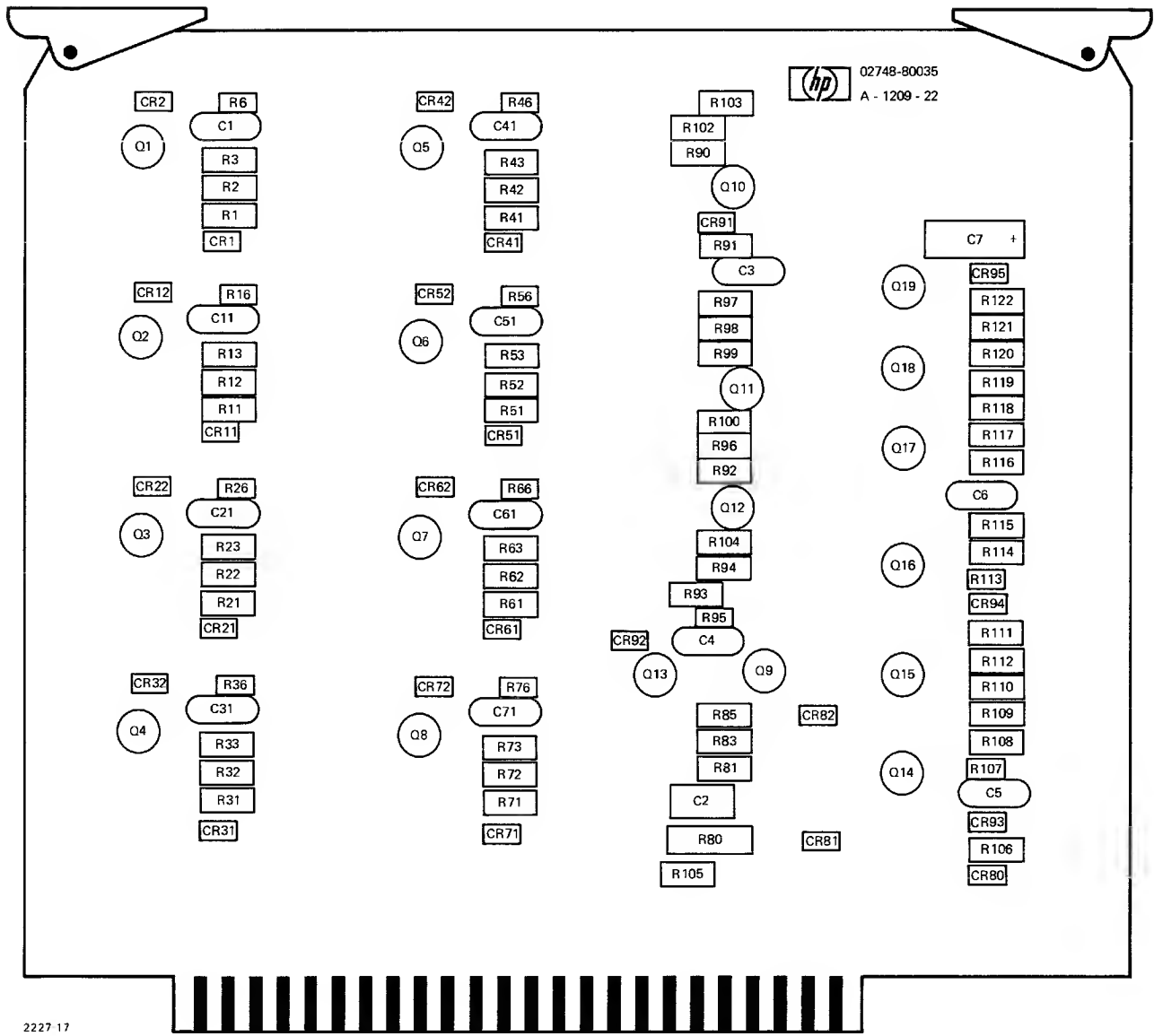
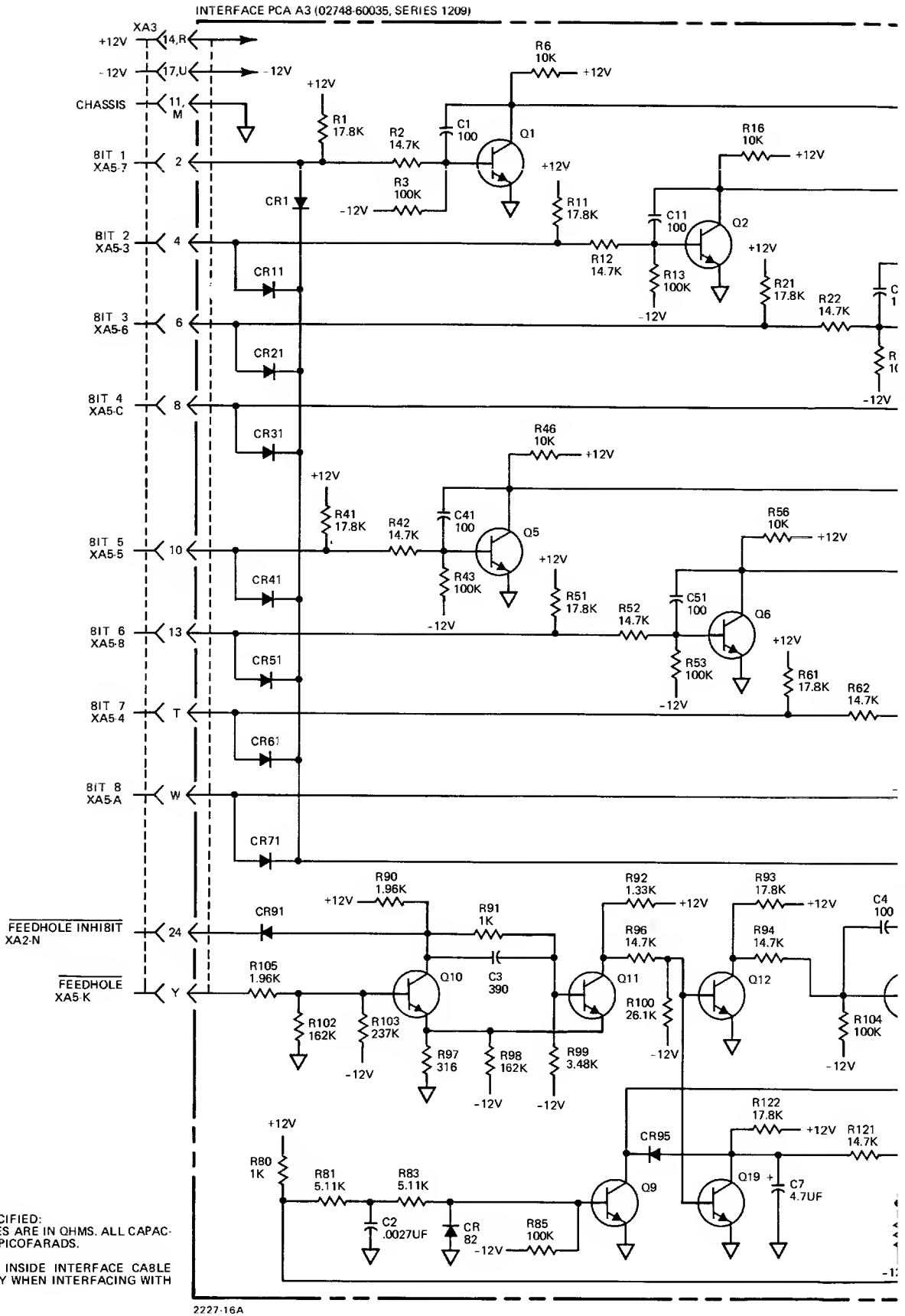


Figure 4-7. Read Head Assembly A5 Schematic Diagram



2227-17

- NOTES:
1. UNLESS OTHERWISE SPECIFIED: ALL RESISTANCE VALUES ARE IN OHMS. ALL CAPACITANCE VALUES ARE IN PICO FARADS.
 2. TTL CLAMP JUMPED INSIDE INTERFACE CABLE CONNECTOR. USED ONLY WHEN INTERFACING WITH TTL LOGIC ELEMENTS.



2227-16A

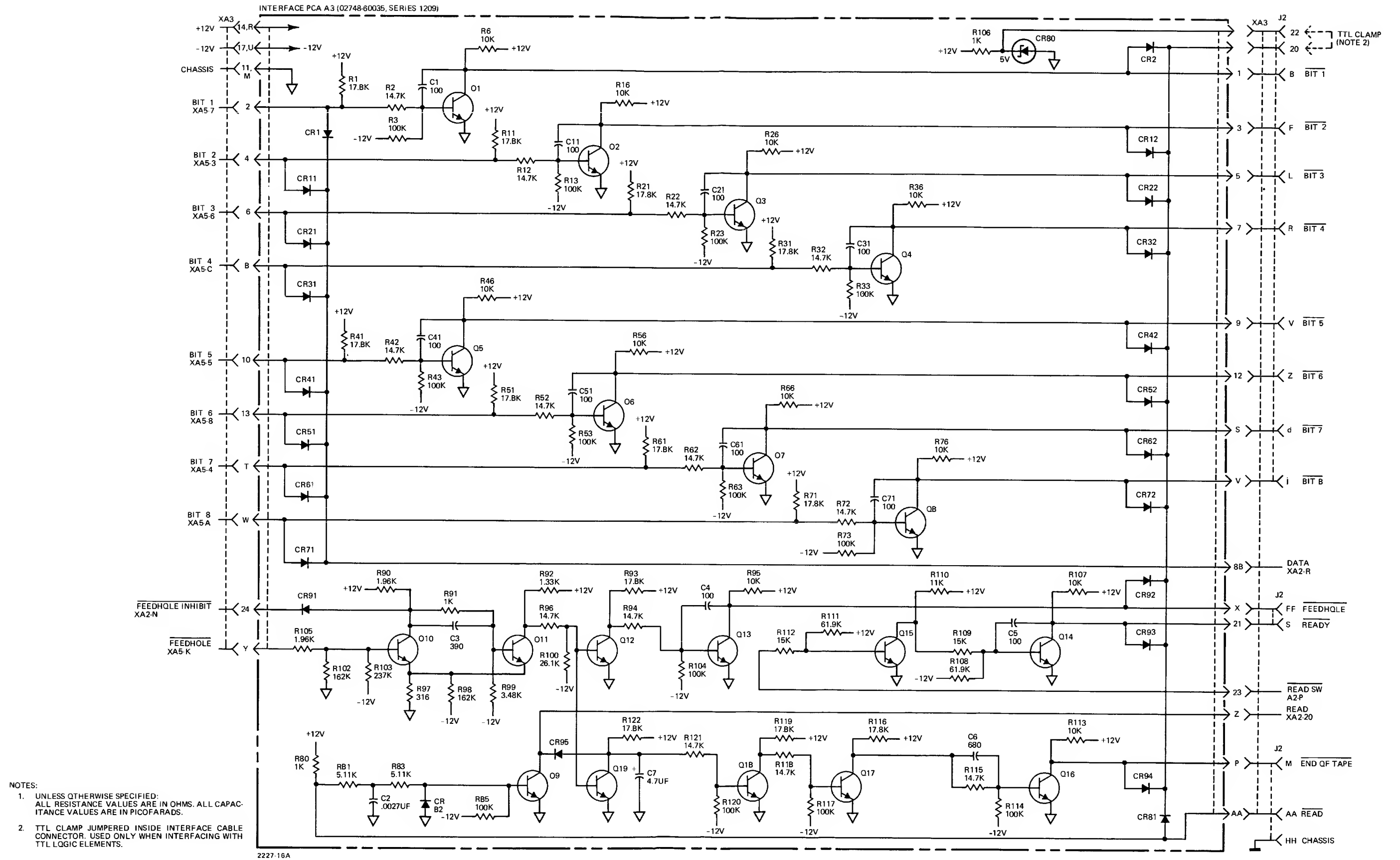
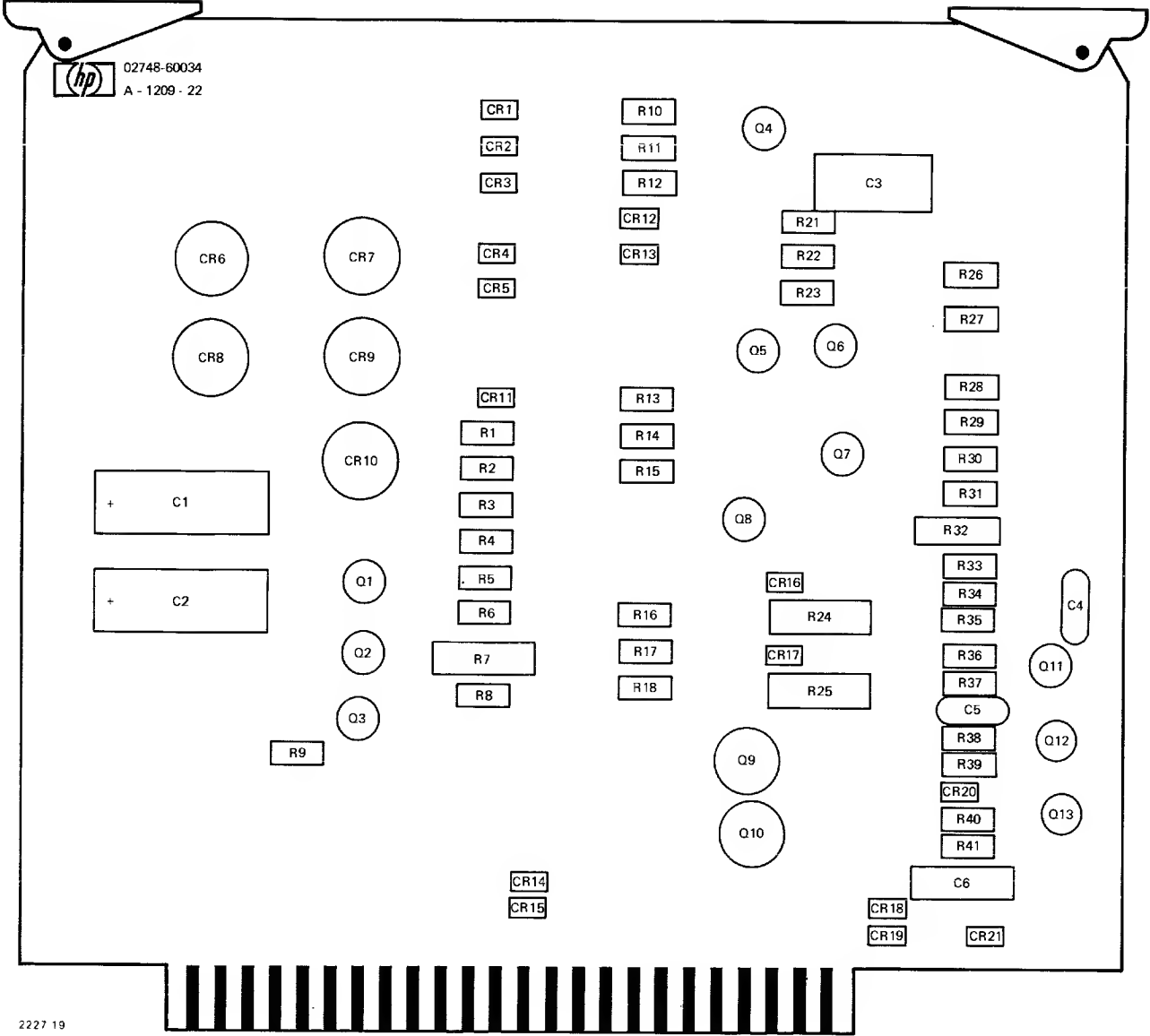
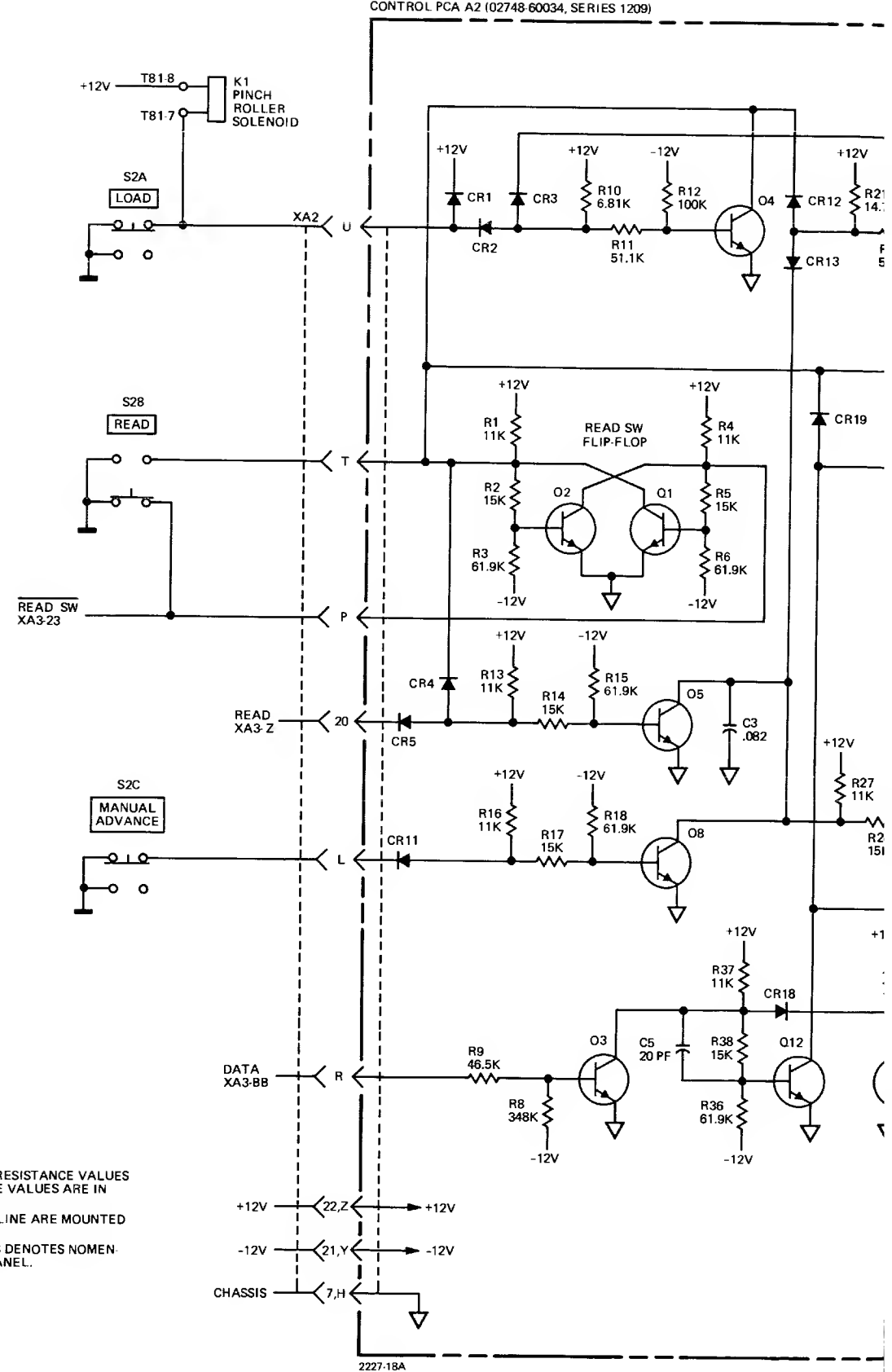


Figure 4-8. Interface PCA A3 Schematic and Parts Location Diagram



2227 19

- NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCE VALUES ARE IN OHMS AND ALL CAPACITANCE VALUES ARE IN MICROFARADS.
 2. PARTS SHOWN OUTSIDE OF BROKEN LINE ARE MOUNTED ON MAIN CHASSIS.
 3. INFORMATION SHOWN IN BOXES DENOTES NOMENCLATURE ON INSTRUMENT FRONT PANEL.



2227-18A

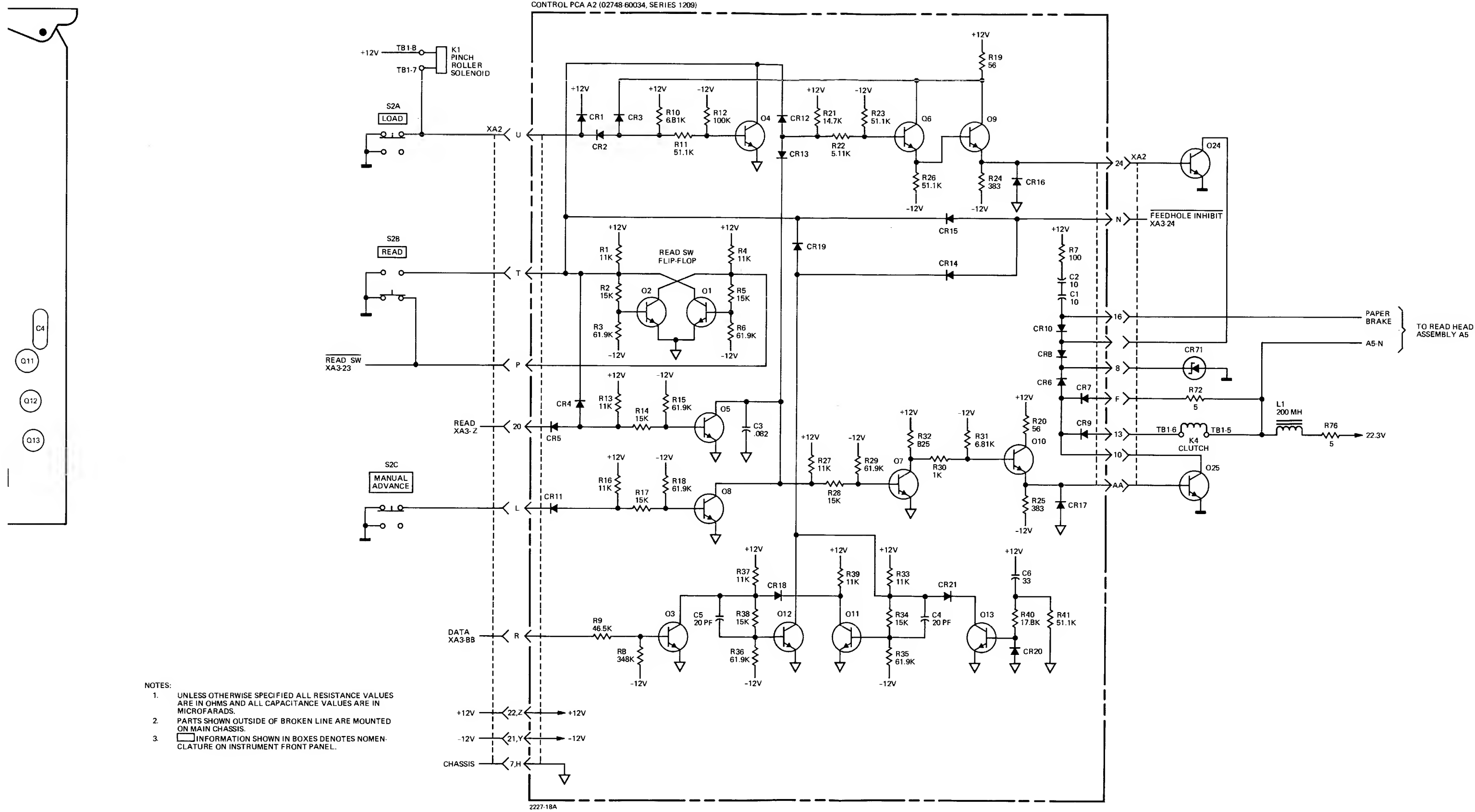
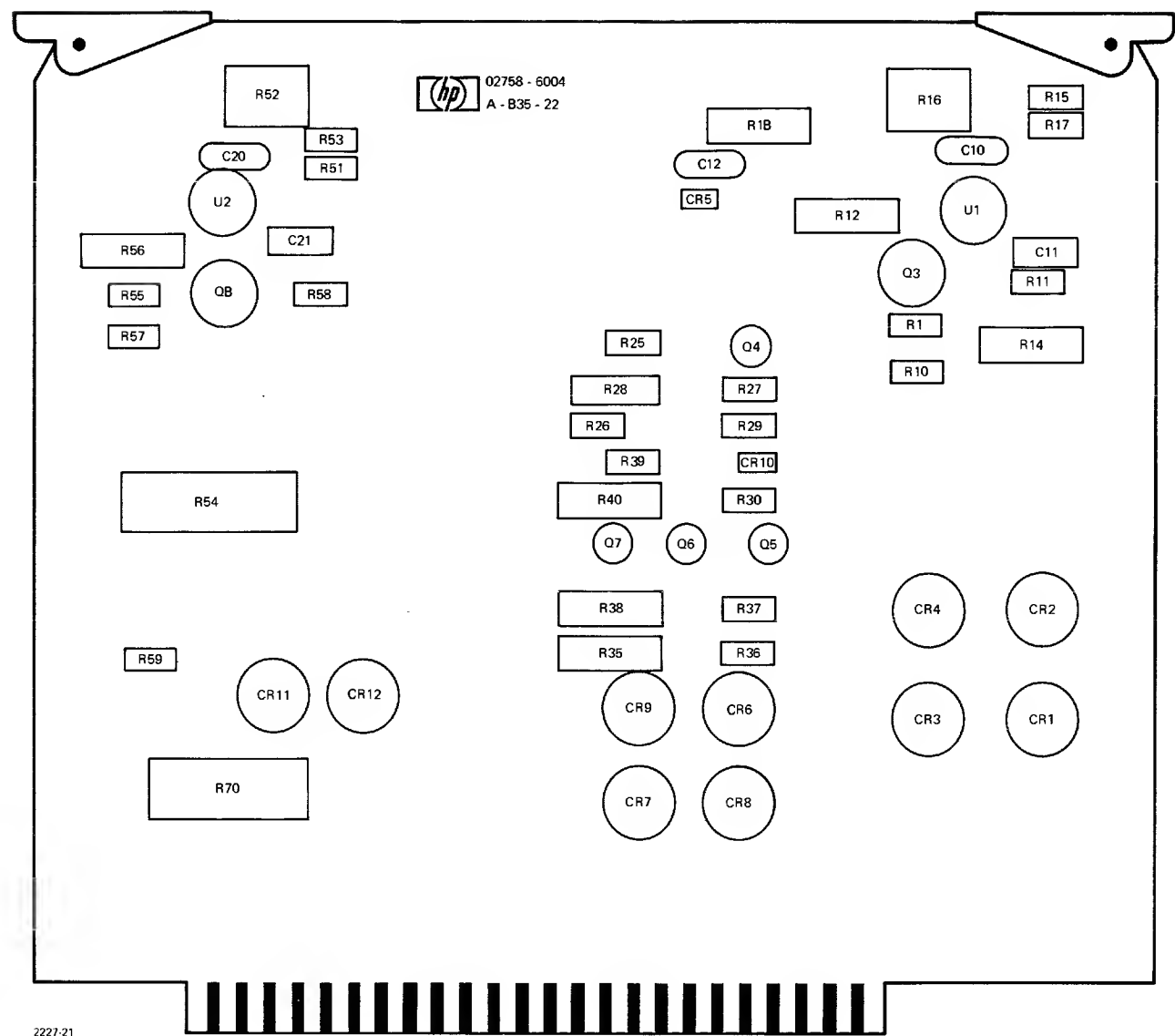
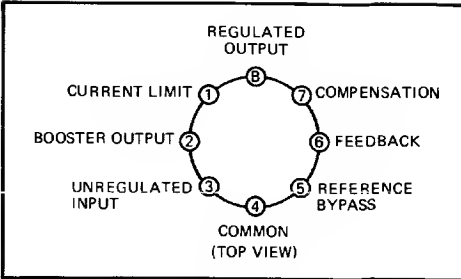


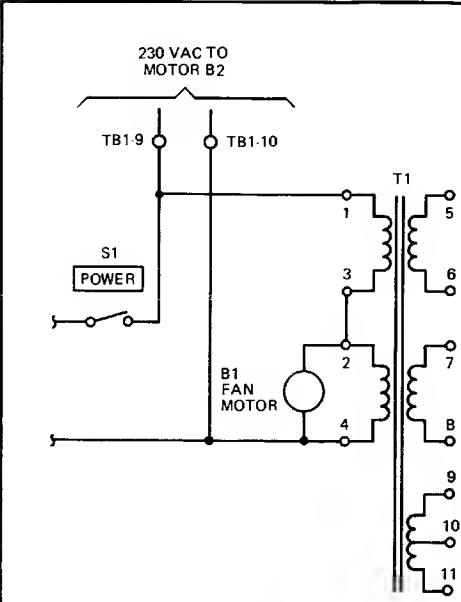
Figure 4-9. Control PCA A2 Schematic and Parts Location Diagram



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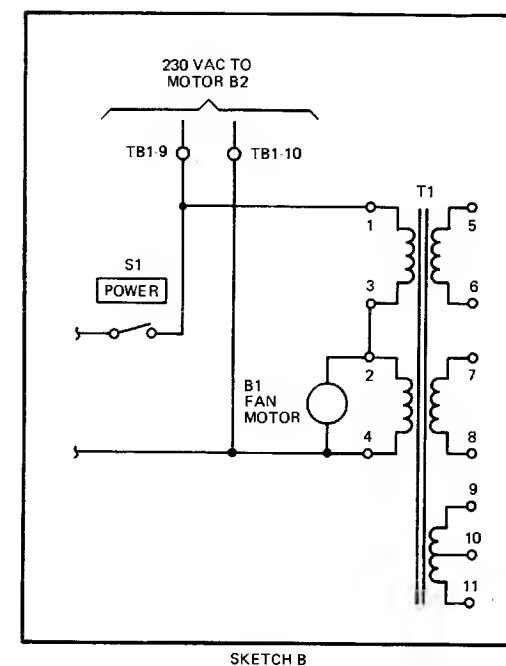
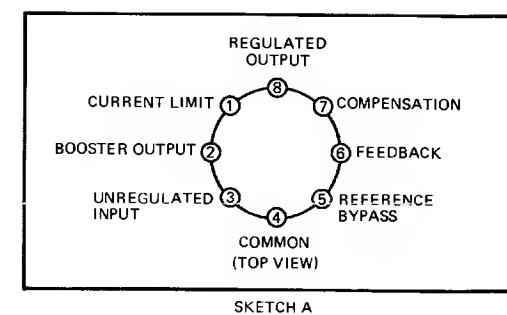
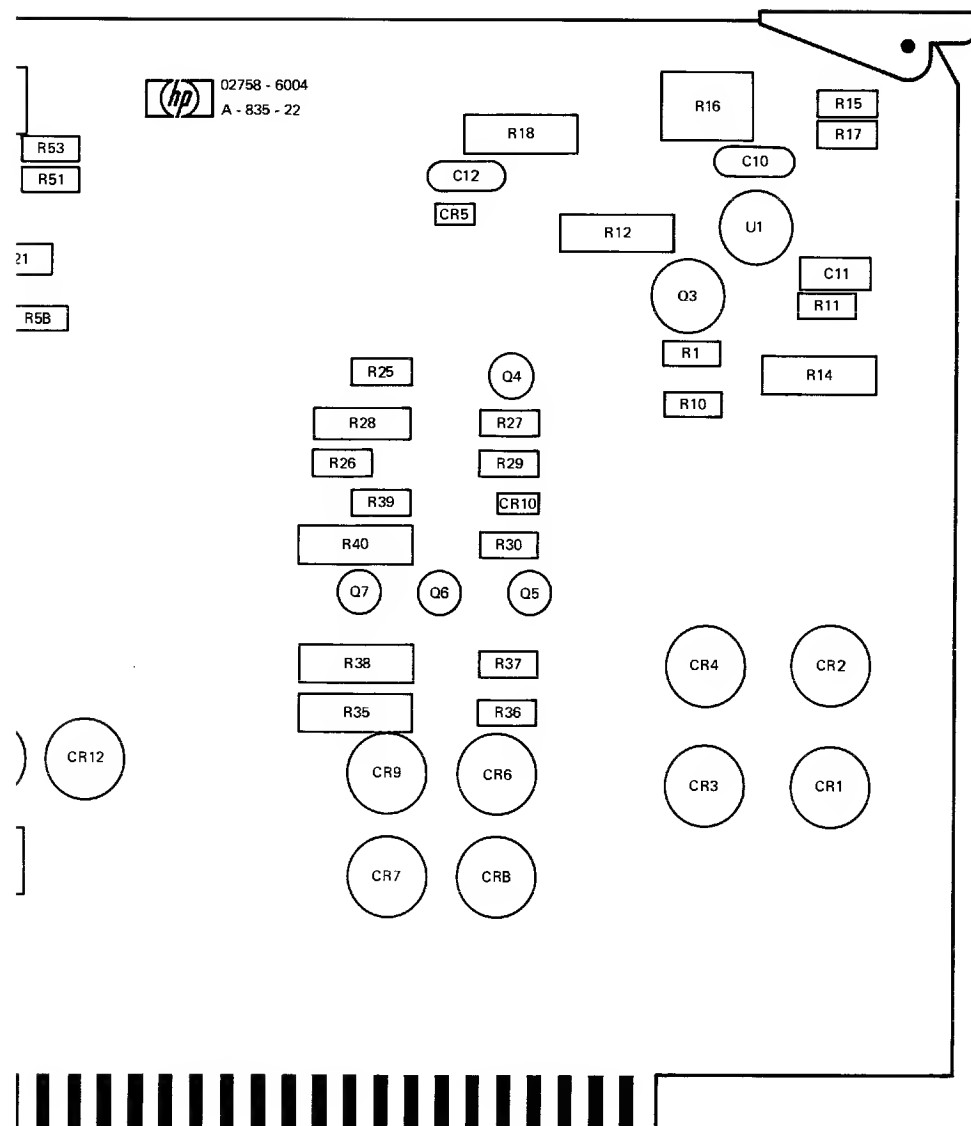


SKETCH A



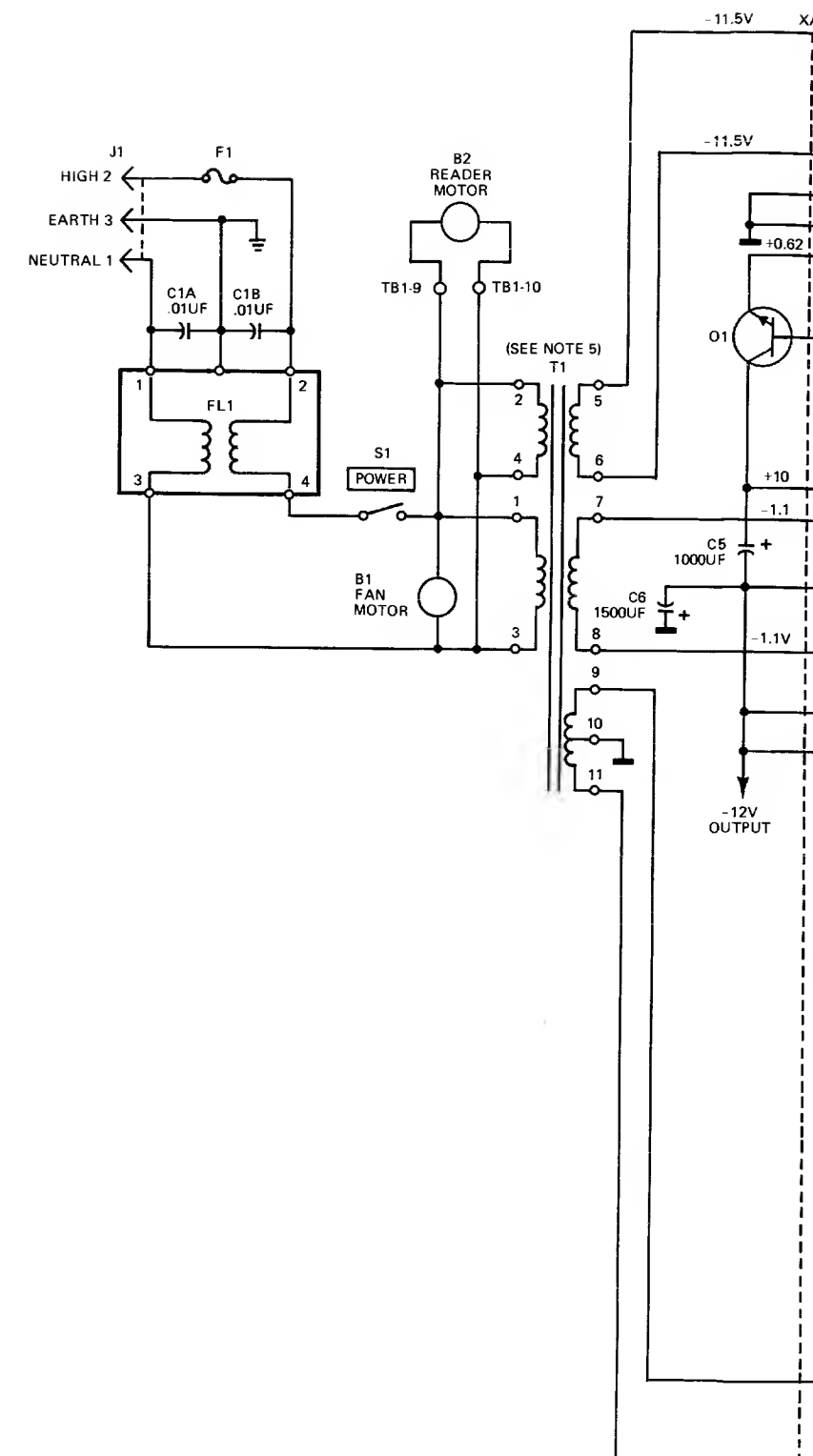
SKETCH B

- NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCE VALUES ARE IN OHMS. ALL CAPACITANCE VALUES ARE IN PICOFARADS.
 2. PARTS SHOWN OUTSIDE OF BROKEN LINE ARE MOUNTED ON MAIN CHASSIS.
 3. INFORMATION SHOWN IN BOXES DENOTES NOMENCLATURE ON TAPE READER FRONT PANEL.
 4. REFERENCE VOLTAGES SHOWN ARE FOR TROUBLE SHOOTING PURPOSES AND REPRESENT NOMINAL VALUES. VOLTAGE MEASUREMENTS WERE TAKEN WITH LINE VOLTAGE AT 115 VAC, (OR 230 VAC FOR OPTION 001), POWER SWITCH ON, AND LOAD, READ AND MANUAL ADVANCE SWITCHES OFF.
 5. TRANSFORMER T1 IS SHOWN WIRED FOR 115 VAC OPERATION. IF TAPE READER IS EQUIPPED WITH OPTION 001 (230 VAC, 50 HZ OPERATION), T1 IS WIRED AS SHOWN IN SKETCH B.



NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCE VALUES ARE IN OHMS. ALL CAPACITANCE VALUES ARE IN PICO FARADS.
2. PARTS SHOWN OUTSIDE OF BROKEN LINE ARE MOUNTED ON MAIN CHASSIS.
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4. REFERENCE VOLTAGES SHOWN ARE FOR TROUBLE-SHOOTING PURPOSES AND REPRESENT NOMINAL VALUES. VOLTAGE MEASUREMENTS WERE TAKEN WITH LINE VOLTAGE AT 115 VAC, (OR 230 VAC FOR OPTION 001), POWER SWITCH ON, AND LOAD, READ, AND MANUAL ADVANCE SWITCHES OFF.
5. TRANSFORMER T1 IS SHOWN WIRED FOR 115 VAC OPERATION. IF TAPE READER IS EQUIPPED WITH OPTION 001 (230 VAC, 50 HZ OPERATION), T1 IS WIRED AS SHOWN IN SKETCH B.



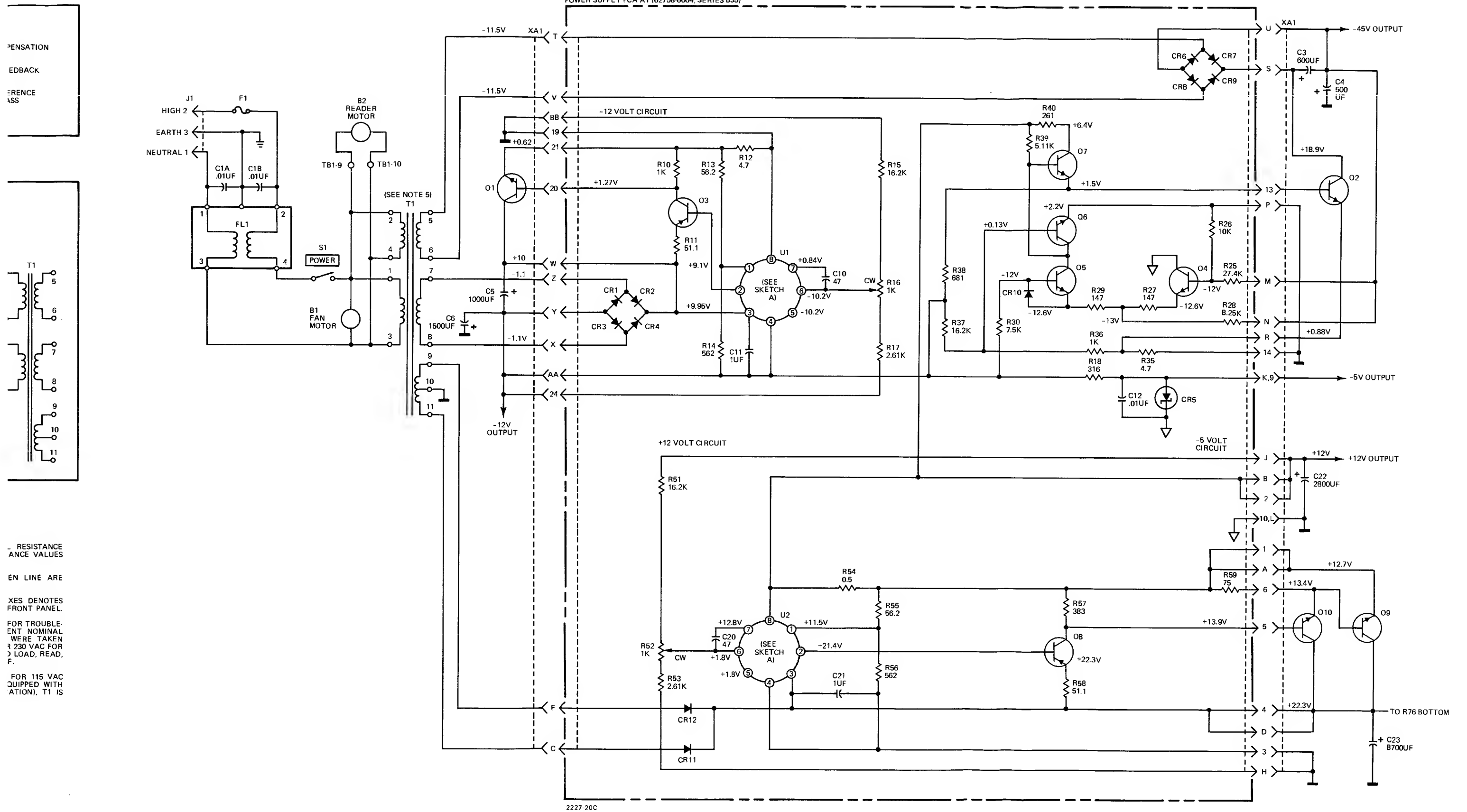


Figure 4-10. Power Supply PCA A1 Schematic and Parts Location Diagram

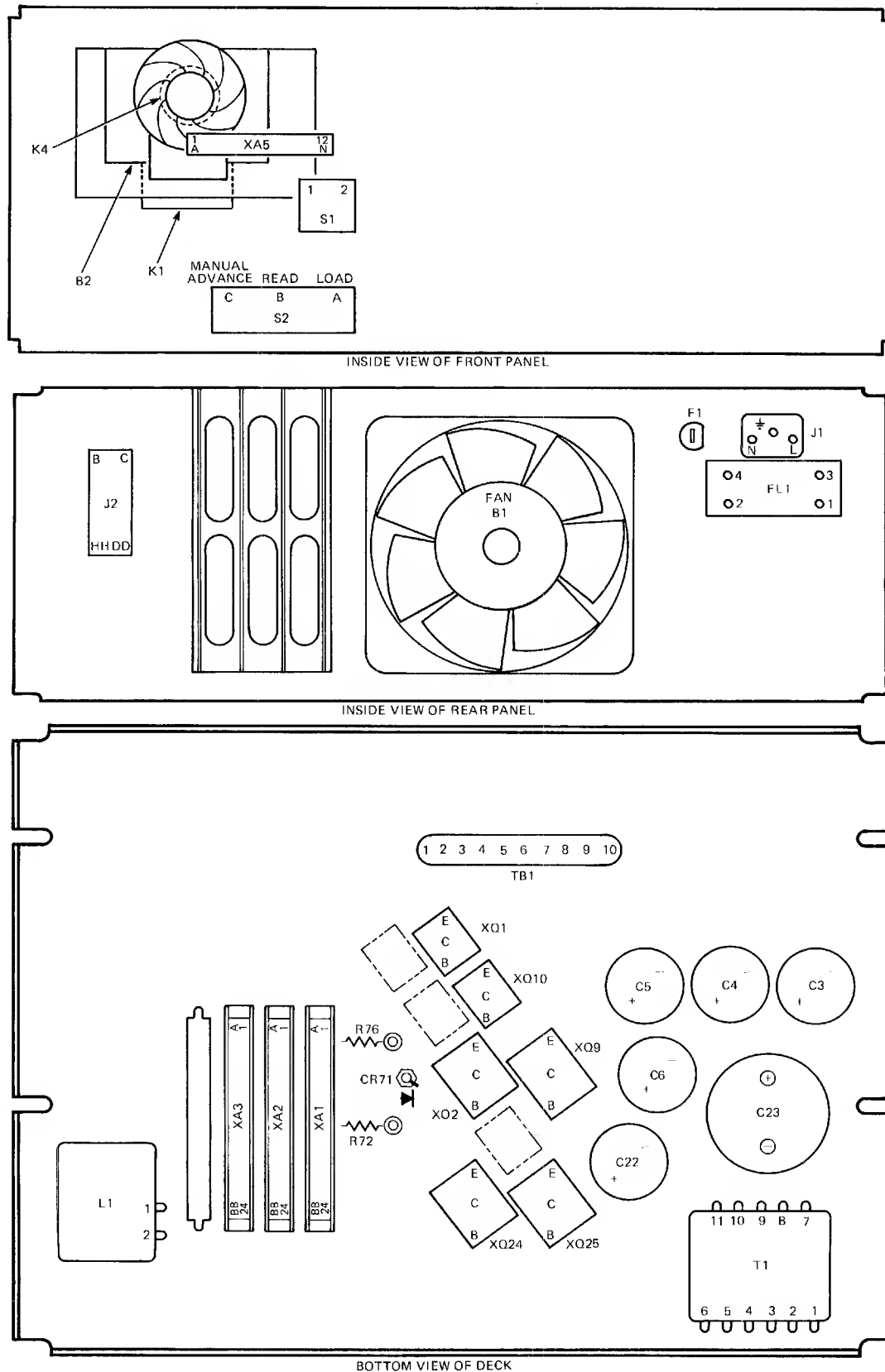


Figure 4-11. Wiring Terminal Location Diagram

5-1. INTRODUCTION.

5-2. This section contains information for ordering replacement parts for the tape reader. Figures 5-1, 5-3, and 5-4 are parts location diagrams for the unit. Figure 5-2 is an exploded view of the front panel assembly. Tables 5-1 through 5-4 are parts lists for the parts called out in figures 5-1 through 5-4 respectively. Index numbers for the parts in the figures and tables correspond to disassembly sequence for the unit or assembly, except for attaching parts which are listed immediately after the parts they attach.

5-3. REPLACEABLE PARTS LISTS.

5-4. Separate parts lists and parts location diagrams are provided for each printed-circuit assembly. These are located in section IV of this manual, adjacent to the respective schematic diagrams for the PCA. Parts are listed in these tables in alphanumeric order by reference designation. The columns in these tables provide the following information for each part:

- a. **REFERENCE DESIGNATION.** The assembly designation and complete reference designation for each replaceable part.
- b. **HP PART NUMBER.** The HP part number for each replaceable part.
- c. **QTY.** The total quantity of a part used on the printed-circuit assembly is listed with the first entry for that part number.
- d. **DESCRIPTION.** The description of each replaceable part. Refer to table 5-7 for an explanation of abbreviations used in the DESCRIPTION column.
- e. **MFR CODE.** A five digit code that denotes a typical manufacturer of a part. Refer to table 5-8 for a list of manufacturers.
- f. **MFR PART NUMBER.** The manufacturer's part number for each replaceable part.

5-5. The columns in tables 5-1 through 5-4 provide the following information for each part:

- a. **FIG. & INDEX NO.** The figure and index number where the replaceable parts are shown in an exploded view or parts location diagram.

- b. **HP PART NO.** The HP part number for each replaceable part.

Note: When "Coml" appears in the HP PART NO. column for a particular part, that part should be available from normal commercial sources.

- c. **DESCRIPTION.** The description of each replaceable part and its applicable reference designation. Also lists special applications (options) of the replaceable part. Refer to table 5-7 for an explanation of abbreviations used in the DESCRIPTION column.
- d. **MFR CODE.** A five digit code that denotes a typical manufacturer of the part. Refer to table 5-8 for a list of manufacturers.

5-6. Items in the DESCRIPTION column of the replaceable parts lists are indented to indicate item relationship. In addition, the symbol "— — — x — — —" follows the last of one or more attaching parts. Indentation is as follows:

MAJOR ASSEMBLY

- * Subassembly
- * Attaching Parts for Subassembly
- ** Subassembly Parts
- ** Attaching Parts for Subassembly Parts

5-7. NUMERICAL LISTS.

5-8. Tables 5-5 and 5-6 are listings of every replaceable part in the tape reader. The parts are segregated by electrical usage (table 5-5) and mechanical usage (table 5-6). Parts are listed in numerical order by part number.

5-9. ORDERING INFORMATION.

5-10. To order replaceable parts, address the order to the local Hewlett-Packard Sales and Service Office listed at the end of this manual. The following information should be included in the order for each replaceable part.

- a. Complete tape reader model number and serial number.
- b. Hewlett-Packard part number for each part.
- c. Complete description for each part as provided in the replaceable parts lists.
- d. Circuit reference designation, if applicable, as shown in the replaceable parts lists.

Table 5-1. HP 2748B Tape Reader Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-1		2748B TAPE READER			
1	02748-00066	* TOP COVER (Used on standard and option A85)			
	02748-00062	* TOP COVER (Used on option X95)			
	Coml	(Attaching Parts)			
		* SCREW, machine, no. 6-32, 0.625 in. flat head			4
		--- x ---			
2	02748-60225	* BOTTOM COVER (Used on standard and option A85)	28480	02748-60225	1
	02748-6019	* BOTTOM COVER (Used on option X95)	28480	02748-6019	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.625 in. flat head			4
		--- x ---			
3	5000-8720	* SIDE COVER (Used on standard and option A85)	28480	5000-8720	1
	5000-0743	* SIDE COVER (Used on option X95)	28480	5000-0743	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 6-32, 0.250 in. flat head			4
		--- x ---			
4	5060-8738	* HANDLE RETAINER (Used on standard and option A85)	28480	5060-8738	1
	5060-0765	* HANDLE RETAINER (Used on option X95)	28480	5060-0765	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 8-32, 0.500 in. pan head			2
		--- x ---			
5	5060-0222	* HANDLE ASSEMBLY, side	28480	5060-0222	1
6	5000-0052	* PLASTIC TRIM	28480	5000-0052	1
7	02748-60036	* FRAME	28480	02748-60036	1
		(Attaching Parts)			
	Coml	* SCREW, machine, no. 8-32, 0.500 in. flat head			4
	Coml	* NUT, assembled washer, no. 8-32			4
	Coml	* SCREW, machine, no. 8-32, 0.625 in. flat head			5
		--- x ---			
8	5020-6851	* EXTRUSION, top (Used on standard)	28480	5020-6851	1
	5020-0901	* EXTRUSION, top (Used on options A85 and X95)	28480	5020-0901	1
9	5020-6850	* EXTRUSION, bottom (Used on standard)	28480	5020-6850	1
	5020-0900	* EXTRUSION, bottom (Used on options A85 and X95)	28480	5020-0900	1
10	No Number	* FRONT PANEL ASSEMBLY (See figure 5-2.)			
11	No Number	* DECK ASSEMBLY (See figure 5-3.)			
12	No Number	* REAR PANEL ASSEMBLY (See figure 5-4.)			
		ACCESSORIES (not shown in figure 5-1)			
	02748-6002	ACCESSORY KIT	28480	02748-6002	1
	1251-0337	* CONNECTOR, 50 pin	28480	1251-0337	1
	1251-0339	* CONNECTOR, housing	28480	1251-0339	1
	1251-0190	* PIN, connector, male	28480	1251-0190	11
	8520-0017	* BRUSH, nylon	28480	8520-0017	1
	5060-8306	* LUBRICATING KIT	28480	5060-8306	1
	02758-6017	* EXTENDER BOARD ASSEMBLY	28480	02758-6017	1
	5060-0767	FOOT ASSEMBLY	28480	5060-0767	4
	5060-8741	RACK MOUNTING KIT (used on standard)	28480	5060-8741	1
	5060-0776	RACK MOUNTING KIT (used on options X95 and A85)	28480	5060-0776	1
	8120-1378	POWER CORD (used on standard)	28480	8120-1378	1
	8120-1348	POWER CORD (used on option 001 only)	28480	8120-1348	1
	02748-90032	2748B TAPE READER OPERATING AND SERVICE MANUAL	28480	02748-90032	1

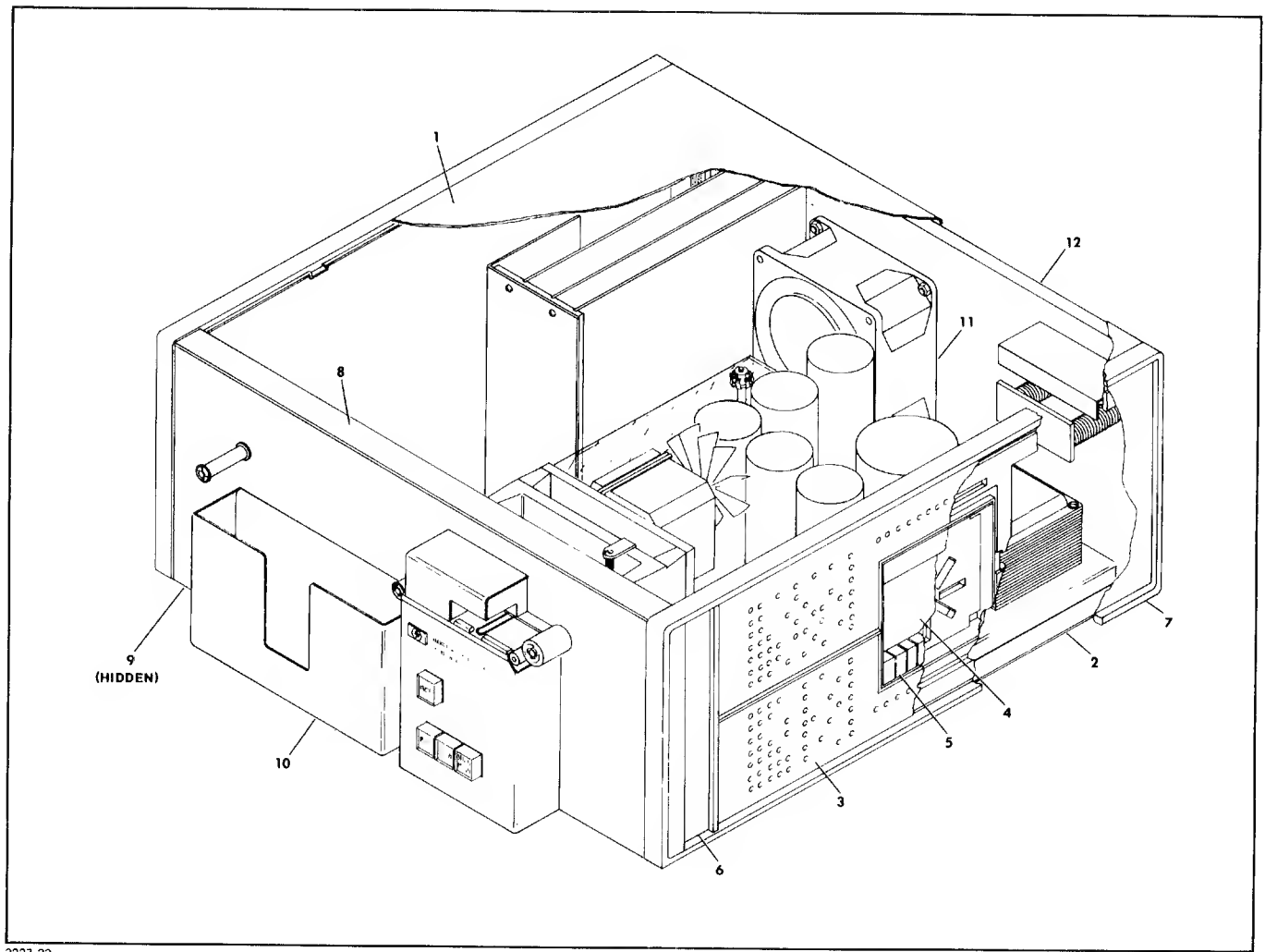


Figure 5-1. HP 2748B Tape Reader Parts Location Diagram

Table 5-2. Front Panel Assembly Replaceable Parts

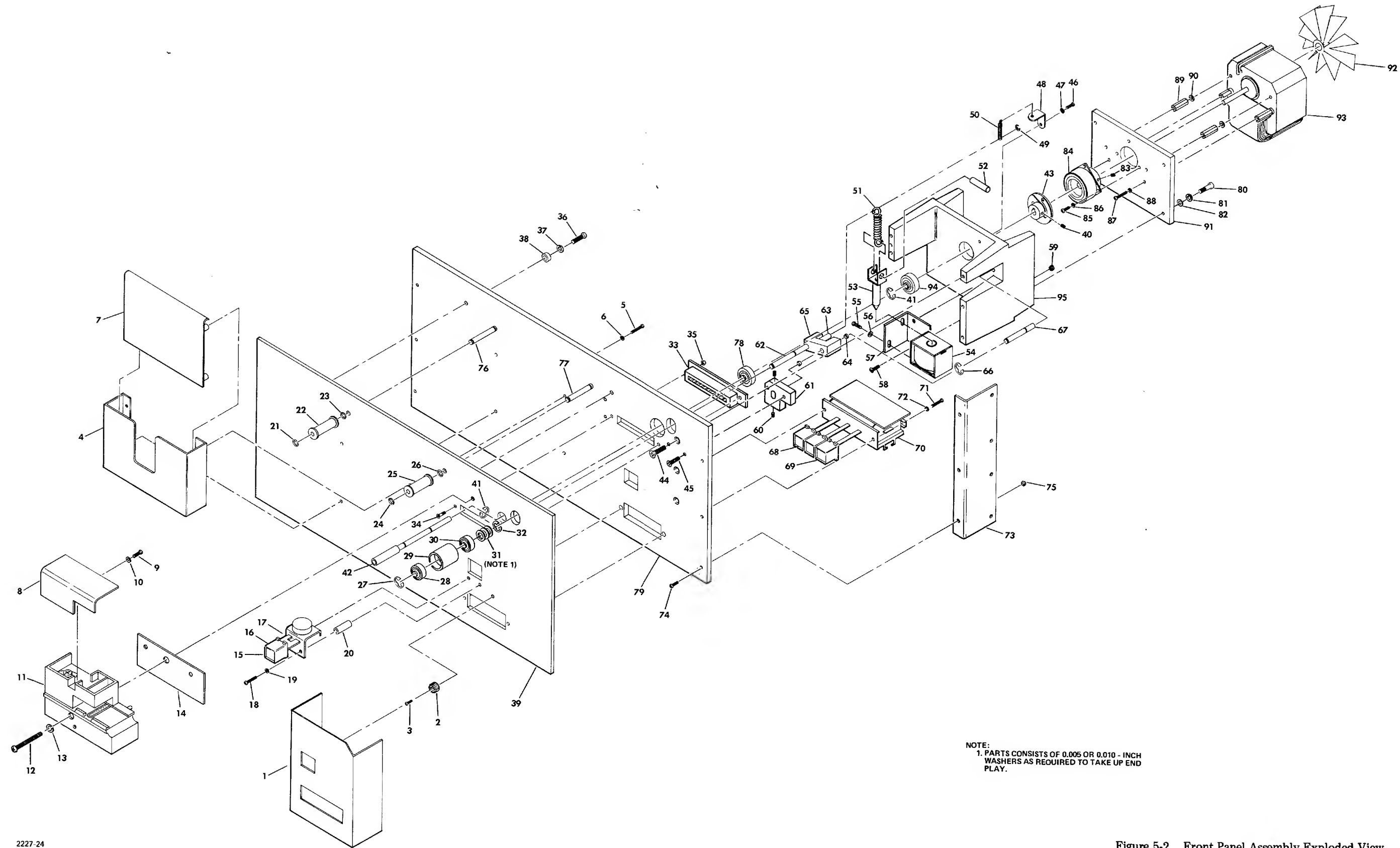
FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-2	No Number	FRONT PANEL ASSEMBLY (10, figure 5-1)			
1	02748-00065	* CONTROL PANEL (used on standard)	28480	02748-00065	1
	02748-0005	* CONTROL PANEL (used on options X95 and A85)	28480	02748-0005	1
2	1390-0107	* BUTTON LATCH (Attaching Parts)	13061	B10-B1	1
3	Coml	* SCREW, machine, no. 4-40, 0.375 in. flat head --- x ---			1
4	02748-00064	* CONTAINER, paper tape (used on standard)	28480	02748-00064	1
	02748-0002	* CONTAINER, paper tape (used on options X95 and A85) (Attaching Parts)	28480	02748-0002	1
5	Coml	* SCREW, machine, no. 4-40, 1/2 in. pan head			4
6	Coml	* WASHER, split lock, no. 4			4
7	02748-00068	* PLATE (used on standard)	28480	02748-00068	1
	02748-0003	* PLATE (used on options X95 and A85) --- x ---	28480	02748-0003	1
8	02758-0168	* READ HEAD COVER (used on standard)	28480	02758-0168	1
	02758-0001	* READ HEAD COVER (used on options X95 and A85) (Attaching Parts)	28480	02758-0001	1
9	Coml	* SCREW, machine, no. 4-40, 0.250 in. pan head			1
10	Coml	* WASHER, split lock, no. 4 --- x ---			1
11	Coml	* READ HEAD ASSEMBLY (A5) (Attaching Parts)	28480	02748-6003	1
12	Coml	* SCREW, machine, no. 8-32, 1.750 in. pan head			1
13	Coml	* WASHER, split lock, no. 8 --- x ---			1
14	02758-0015	* GASKET, read head	28480	02758-0015	1
15	02758-8006	* LABEL	28480	02758-8006	1
16	0370-1400	* PUSHBUTTON (used on standard)	28480	0370-1400	1
	0370-0118	* PUSHBUTTON (used on options X95 and A85)	28480	0370-0118	1
17	5080-1570	* SWITCH, pushbutton (S1) (Attaching Parts)	28480	5080-1570	1
18	Coml	* SCREW, machine, no. 4-40, 1.500 in. pan head			1
19	Coml	* WASHER, split lock, no. 4			1
20	Coml	* SPACER, 0.750 in. long --- x ---			1
21	Coml	* RING, retaining, 0.187 in.			1
22	02748-2009	* ROLLER, material handling	28480	02748-2009	1
23	Coml	* RING, retaining, 0.187 in.			1
24	Coml	* RING, retaining, 0.187 in.			1
25	02748-2009	* ROLLER, material handling	28480	02748-2009	1
26	Coml	* RING, retaining, 0.187 in.			1
27	Coml	* RING, retaining, 0.250 in.			1
28	Coml	* BEARING, BALL, annular			1
29	02758-2017	* PINCH ROLLER	28480	02758-2017	1
30	Coml	* BEARING, BALL, annular			1
31	Coml	* See figure 5-2 note 1			
32	Coml	* RING, retaining, 0.250 in.			1
33	1251-1190	* CONNECTOR, receptacle (XA5) (Attaching Parts)	71785	251-12-30-261	1
34	Coml	* SCREW, machine, no. 4-40, 0.625 in. flat head			2
35	Coml	* NUT, hexagon, self-locking, no. 4 --- x ---			2
36	Coml	* SCREW, machine, no. 4-40, 0.375 in. pan head			3
37	Coml	* WASHER, split lock, no. 4			3
38	02748-2013	* SPACER	28480	02748-2013	3
39	02748-00067	* PANEL (used on standard)	28480	02748-00067	1
	02748-0001	* PANEL (used on options X95 and A85)	28480	02748-0001	1

Table 5-2. Front Panel Assembly Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-2-40	Coml	* SETSCREW, no. 4-40, 0.125			1
41	Coml	* RING, retaining, 0.250 in.			2
42	02758-2029	* DRIVE SHAFT, main capstan <i>23 2-15-78</i>	28480	02748-2007	1
43	No Number	* CLUTCH PLATE (part of clutch, item 83)			1
44	Coml	* SCREW, machine, no. 8-32, 0.625 in. flat head			1
45	Coml	* SCREW, machine, no. 8-32, 0.500 in. flat head			2
46	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			1
47	Coml	* WASHER, split lock, no. 6			1
48	02758-0013	* BRACKET, spring	28480	02758-0013	1
49	Coml	* RING, returning, 0.125 in.			1
50	Coml	* SPRING, 0.125 in. OD			1
51	Coml	* SPRING, 0.250 in. OD			1
52	No Number	* ARMATURE PIN (part of solenoid, item 53)			1
53	No Number	* ARMATURE (part of solenoid, item 53)			1
54	02758-20468	* SOLENOID (K1) (Attaching Parts)	28480	02758-20468	1
55	Coml	* SCREW, machine, no. 6-32, 0.250 in., w/ext-tooth, pan head			2
56	Coml	* WASHER, flat, no. 6 --- x ---			2
57	02758-00167	* MOUNTING BRACKET, solenoid (Attaching Parts)	28480	02758-00167	1
58	Coml	* SCREW, machine, no. 6-32, 0.625 in., flat head			1
59	Coml	* NUT, hexagon, assembled washer, no. 6-32 --- x ---			2
60	Coml	* SET SCREW, no. 8-32, 0.375 in.			2
61	02758-20466	* SPACER BLOCK	28480	02758-20466	1
62	02758-2023	* SHAFT, load and pinch roller	28480	02758-2023	1
63	Coml	* PIN, split, 0.500 in. long, 0.125 in.			1
64	1410-0045	* BUSHING, bronze, 0.315 OD, 0.189 ID	28480	1410-0045	2
65	02758-2020	* ARM LOAD and PINCH ROLLER	28480	02758-2020	1
66	Coml	* RING, retaining, 0.187 in.			1
67	02748-2001	* SHAFT, pinch roller	28480	02748-2001	1
68	02758-8006	* LABEL	28480	02758-8006	3
69	0370-0118	* PUSHBUTTON	28480	0370-0118	3
70	3101-0729	* SWITCH, pushbutton (S2) (Attaching Parts)	28480	3101-0729	1
71	Coml	* SCREW, machine, no. 6-32, 0.375 in.			2
72	Coml	* WASHER, split lock, no. 6 --- x ---			2
73	02748-0004	* BRACKET, panel (Attaching Parts)	28480	02748-0004	2
74	Coml	* SCREW, machine, no. 8-32, 0.500 in.			3
75	Coml	* NUT, hexagon, no. 8-32 --- x ---			3
76	02748-2011	* IDLER SHAFT	28480	02748-2011	1
77	02748-2011	* IDLER SHAFT	28480	02748-2011	1
78	Coml	* BEARING, BALL, annular			1
79	02748-2001	* PANEL	28480	02748-2001	1
80	Coml	* SCREW, machine, no. 8-32, 0.625 in. skt cap			4
81	Coml	* WASHER, split lock, no. 8			4
82	Coml	* WASHER, flat, no. 8			4
83	Coml	* SETSCREW, no. 4-40, 0.125			1
84	1500-0226	* CLUTCH (Attaching Parts)	16554	BEC-11CC-43	1
85	Coml	* SCREW, machine, no. 4-40, 0.312 in. filh			4
86	Coml	* WASHER, split lock, no. 4 --- x ---			4

Table 5-2. Front Panel Assembly Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-2-87	Coml	* SCREW, machine, no. 6-32, 0.625 in. pan head			4
88	Coml	* WASHER, split lock, no. 6			4
89	No Number	* STANDOFF (part of motor, item 92)			4
90	Coml	* WASHER, flat, no. 6			4
91	02748-2005	* BEARING PLATE	28480	02748-2005	1
92	3160-0222	* FAN ASSEMBLY	81042	6-218-213	1
93	3140-0446	* MOTOR, shaded pole (B2)	28480	3140-0446	1
	3140-0496	* MOTOR, shaded pole, 230V, 50 Hz (B2) (used on option 001 only)	28480	3140-0496	1
94	Coml	* BEARING, BALL, annular			1
95	02748-2014	* CASTING	28480	02748-2014	1



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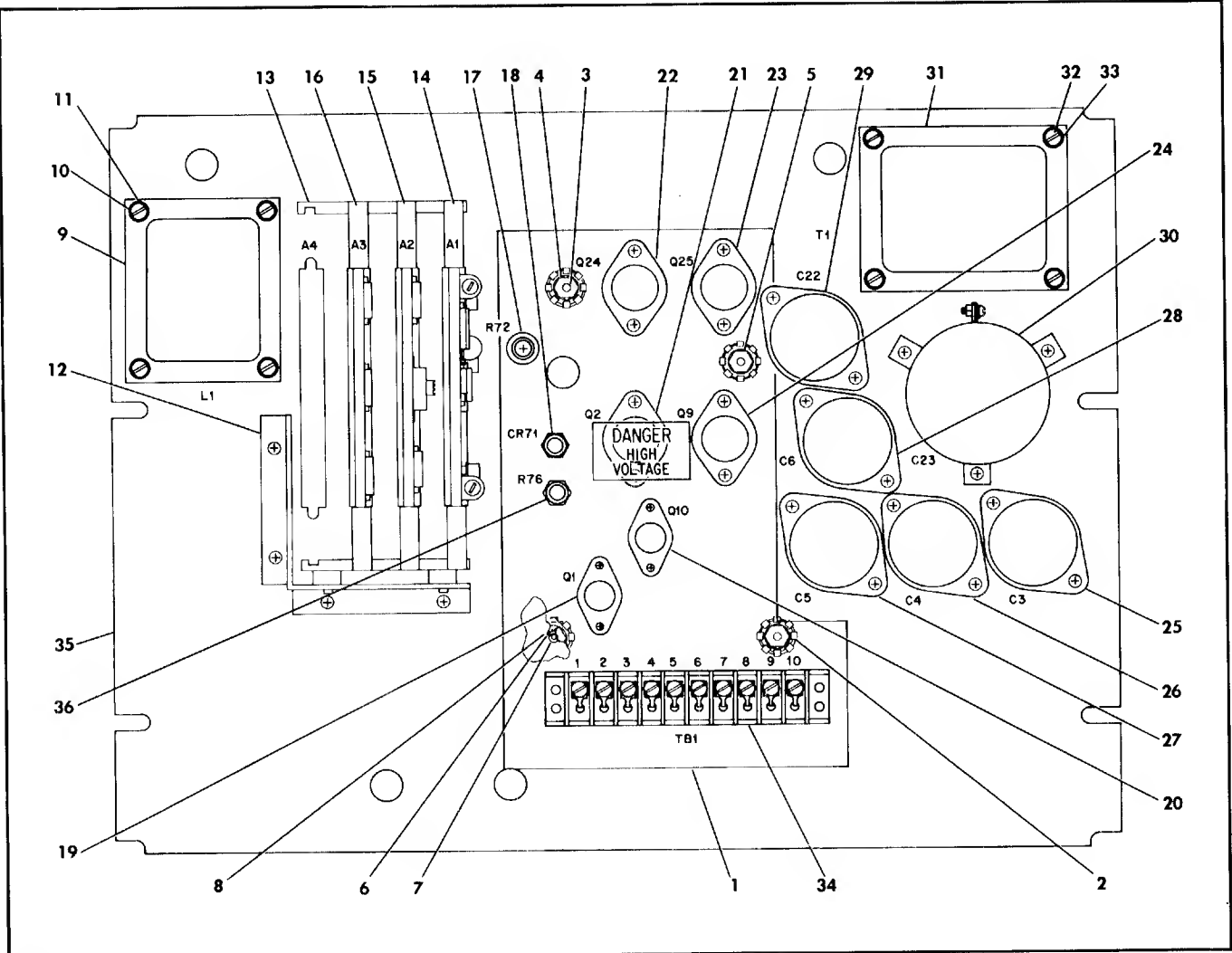
Figure 5-2. Front Panel Assembly Exploded View

Table 5-3. Deck Assembly Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-3-1	No Number	DECK ASSEMBLY (11, figure 5-1)			
1	02758-20464	* SHIELD, high voltage	28480	02758-20464	1
	7120-0137	* DECAL, high voltage	83309	3521	3
2	1390-0107	* BUTTON LATCH (Attaching Parts)	13061	B10-B1	4
3	Coml	* SCREW, machine, no. 6-32, 0.625, pan head			4
4	Coml	* NUT, hexagon, assembled washer, no. 6-32			4
5	Coml	* WASHER, flat, no. 6			4
	Coml	* SCREW, machine, no. 6-32, 0.375 in. flat head ---- x ----			4
6	02758-20465	* SPACER (Attaching Parts)	28480	02758-20465	4
7	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			4
8	Coml	* WASHER, split lock, no. 6 ---- x ----			4
9	9100-2801	* CHOKE, 2 ohms, 1A (L1) (Attaching Parts)	28480	9100-2801	1
10	Coml	* SCREW, machine, no. 8-32, 2.250 in. slotted head			4
11	Coml	* WASHER, nonmettalic, no. 8			4
	Coml	* NUT, hexagon, no. 8-32			4
	Coml	* WASHER, split lock, no. 6			4
	Coml	* NUT, assembled washer, no. 8-32 ---- x ----			4
12	02758-0002	* PC GUIDE BRACKET (Attaching Parts)	28480	02758-0002	1
	Coml	* SCREW, machine, no. 6-32, 0.625 in. pan head			4
	Coml	* WASHER, split lock, no. 6 ---- x ----			4
13	02758-2008	* PC GUIDE (Attaching Parts)	28480	02758-2008	1
	Coml	* SCREW, machine, no. 6-32, 0.625			2
	Coml	* WASHER, split, no. 6			2
	Coml	* SPACER, 0.562 in.			2
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			2
	Coml	* NUT, hexagon, no. 6-32 ---- x ----			4
14	02758-6004	* POWER SUPPLY PCA (A1) (see figure 4-7)	28480	02758-6004	1
15	02748-60034	* CONTROL PCA (A2) (see figure 4-6)	28480	02748-60034	1
16	02748-60035	* INTERFACE PCA (A3) (see figure 4-5)	28480	02748-60035	1
17	0811-1654	* RESISTOR, fixed, vvv, 5 ohms, 5%, 20W (R72)	28480	0811-1654	1
18	1902-0035	* DIODE, breakdown, 120V, 10W (CR71)	28480	1902-0035	1
19	1854-0072	* TRANSISTOR, Si, NPN (Q1) (Attaching Parts)	02735	2N3054	1
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			2
	1200-0168	* SOCKET, transistor (XQ1) ---- x ----	28480	1200-0168	1
20	1854-0072	* TRANSISTOR, Si, NPN (Q10) (Attaching Parts)	02735	2N3054	1
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			1
	1200-0168	* SOCKET, transistor (XQ1) ---- x ----	28480	1200-0168	1
21	1854-0217	* TRANSISTOR, Si, NPN (Q2) (Attaching Parts)	02735	2N3442	1
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			2
	1200-0041	* SOCKET, transistor (XQ2)	28480	1200-0041	1
22	1854-0217	* TRANSISTOR, Si, NPN (Q24) (Attaching Parts)	02735	2N3442	1
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			1
	1200-0041	* SOCKET, transistor (XQ24) ---- x ----	28480	1200-0041	1

Table 5-3. Deck Assembly Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-3-23	1854-0217	* TRANSISTOR, Si, NPN (Q25) (Attaching Parts)	02735	2N3442	1
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			2
	1200-0041	* SOCKET, transistor (XQ25) ---- x ----	28480	1200-0041	1
24	1854-0217	* TRANSISTOR, Si, NPN (Q9) (Attaching Parts)	02735	2N3442	1
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			2
	1200-0041	* SOCKET, transistor (XQ9) ---- x ----	28480	1200-0041	1
25	0180-0046	* CAPACITOR, fxd, elctlt, 600 uF, -10 +75%, 200 Vdcw, (C3)	56289	D32569-DFP	1
26	0180-0047	* CAPACITOR, fxd, A1, 500 uF, 75 Vdcw (C4)	56289	D32443-DFP	1
27	0180-0056	* CAPACITOR, fxd, elctlt, 1000 uF, 50 Vdcw (C5)	56289	D32429-DFP	1
28	0180-0198	* CAPACITOR, fxd, elctlt, 1500 uF, 50 Vdcw (C6)	56289	D42962-DFP	1
29	0180-0204	* CAPACITOR, fxd, A1, elctlt, 2800 uF, -10 +100%, 40 Vdcw (C22)	56289	D37694-DFP	1
30	0180-1869	* CAPACITOR, fxd, A1, elctlt, 8700 uF, -10 +75%, 500 Vdcw (C23) (Attaching Parts)	56289	DF2A-DQC	1
	Coml	* SCREW, machine, no. 6-32, 0.375 in. pan head			3
	Coml	* WASHER, split lock, no. 6			3
	Coml	* NUT, assembled washer, no. 6 ---- x ----			3
31	9100-1234	* TRANSFORMER, power (T1) (Attaching Parts)	28480	9100-1234	1
32	Coml	* SCREW, machine, no. 8-32, 2.250 in. slotted head			4
33	Coml	* WASHER, nonmetallic, no. 8			4
	Coml	* NUT, assembled washer, no. 8-32 ---- x ----			4
34	0360-1156	* BARRIER BLOCK, 10 term (TB) (Attaching Parts)	71785	353-18-10-001	1
	Coml	* SCREW, machine, no. 6-32, 0.500 in. pan head ---- x ----			2
35	0811-1654	* RESISTOR, fxd, ww, 5 ohms, 5%, 20W (R76)	28480	0811-1654	1
36	02758-0004	* DECK PLATE	28480	02758-0004	1



2227-25

Figure 5-3. Deck Assembly Parts Location Diagram

Table 5-4. Rear Panel Assembly Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5-4-1	No Number 1251-0338	REAR PANEL ASSEMBLY (12, figure 5-1) * INSERT, connector, 50 pin (J2) (Attaching Parts)	95238	25-50-SS	1
	Coml	* SCREW, machine, no. 4-40, 0.375 in. pan head			4
	Coml	* WASHER, split lock, no. 4			4
	Coml	* NUT, hexagon, no. 4-40 --- x ---			4
2	02758-2008	* PC GUIDE (Attaching Parts)	28480	02758-2008	1
		* SCREW, machine, no. 6-32, 0.625 in. pan head			2
		* SCREW, machine, no. 6-32, 1.250 in. pan head			2
		* WASHER, split lock, no. 6			4
		* SPACER, 0.562 in.			2
		* NUT, hexagon, no. 6-32 --- x ---			4
3	02758-0003	* PC GUIDE BRACKET (Attaching Parts)	28480	02758-0003	1
		* SCREW, machine, no. 6-32, 0.375 in. pan head			2
		* WASHER, split lock, no. 6 --- x ---			2
4	5060-0878	* FILTER, air, fan	28480	5060-0878	1
5	5000-8015	* GUARD, fan (Attaching Parts)	28480	5000-8015	1
		* SCREW, machine, no. 6-32, 0.500 in. pan head --- x ---			4
6	3160-0224	* FAN ASSEMBLY, tubeaxial (B1) (Attaching Parts)	99743	WS210F-510	1
		* SCREW, machine, no. 6-32, 0.750 in. flat head			4
		* NUT, assembled washer, no. 6-32			4
		* CABLE ASSEMBLY --- x ---			1
7	02758-0016	* SHIELD (Attaching Parts)	28480	02758-0016	1
		* SCREW, machine, no. 6-32, 0.375 in. pan head			2
		* WASHER, split lock, no. 6 --- x ---			2
8	Coml	* FUSE, 5A (F1)			1
		* FUSE, 2.5A (F1) (used on option 001 only)			1
9	1400-0084	* FUSEHOLDER (XF1)	75915	342014	1
10	1251-2357	* CONNECTOR, receptacle, power (J1)	82389	AC3G	1
11	0150-0119	* CAPACITOR, fxd, cer, 2 x 0.1 uF, 20%, 2500 Vdcw (C1)	56289	32C219A-CDH	1
12	5080-7149	* LINE FILTER (FL1) (Attaching Parts)	28480	5080-7149	1
		* SCREW, machine, no. 4-40, 0.375 in. pan head			2
		* WASHER, split lock, no. 4			2
13	5020-1917	* STANDOFF --- x ---	28480	5020-1917	2
14	02748-0006 02748-00063	* REAR PANEL	28480	02748-0006	1
		* REAR PANEL (used on option 001 only) (Attaching Parts)	28480	02748-00063	1
		* SCREW, machine, no. 8-32, 0.375 in. pan head			2
		* WASHER, split lock, no. 8 --- x ---			2

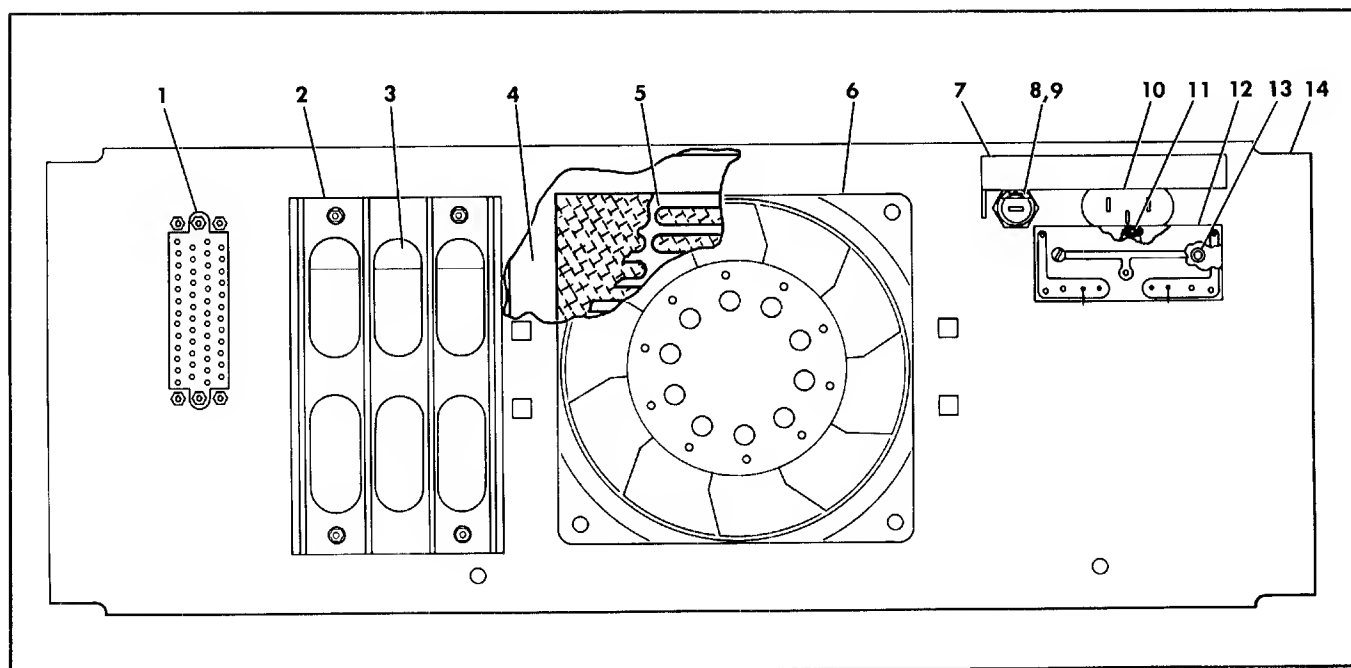


Figure 5-4. Rear Panel Assembly Parts Location Diagram

Table 5-5. Numerical Listing of Electrical Parts

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
0140-0200	C:Fxd, Mica, 390 pF, 5%	72136	RDM15F391-J3C	6
0140-0208	C:Fxd, Mica, 680 pF, 5%	72136	RDM15F691J3C	1
0150-0119	CAPACITOR, fxd, cer, 2 x 0 uF, 20%, 2500 Vdcw	56289	32C19A-CDH	1
0160-0167	C:Fxd, My, 0.082 uF, 10%, 200 Vdcw	56289	192PB2392-PTS	1
0160-0300	C:Fxd, My, 0.0027 uF, 200 Vdcw	56289	192P27292-PTS	1
0160-2055	C:Fxd, Cer, 0.01 uF, +80 - 20%, 100 Vdcw	56289	C023F101F103ZS22-CD	1
0160-2198	C:Fxd, Mica, 20 pF, 5%	72136	RDM15C200J3C	2
0160-2204	C:Fxd, Mica, 100 pF, 5%	72136	RDM15F101J3C	10
0160-2307	C:Fxd, Mica, 300 pF, 5%	28480	0160-2207	2
0180-0046	CAPACITOR, fxd, elctlt, 600 uF, -10 +75%, 200 Vdcw	56289	D32569-DFP	1
0180-0047	CAPACITOR, fxd, A1, 500 uF, -10 +75%, 200 Vdcw	56289	D32569-DFP	1
0180-0056	CAPACITOR, fxd, elctlt, 1000 uF, 50 Vdcw	56289	D32429-DFP	1
0180-0089	C:Fxd, A1 Elect, 10 uF, +50 - 10%, 150 Vdcw	56289	D106F150DD2-DSM	2
0180-0100	C:Fxd, Elect, 4.7 uF, 10%, 35 Vdcw	56289	150D475X9035B2-DYS	1
0180-0198	CAPACITOR, fxd, elctlt, 1500 uF, 50 Vdcw	56289	DA2962-DFP	1
0180-0204	CAPACITOR, fxd, A1-elctlt, 2800 uF, -10 +100%, 40 Vdcw	56289	D37694-DFP	1
0180-0229	C:Fxd, Elect, 33 uF, 10%, 10 Vdcw	28480	0180-0229	1
0180-0291	C:Fxd, Elect, 1.0 uF, 10%, 35 Vdcw	56289	150D105X9035A2-DYS	2
0180-1869	CAPACITOR, fxd, A1-elctlt, 8700 uF, -10 +75%, 50 Vdcw	56289	DF2A-DQC	1
0360-1156	BARRIER BLOCK, 10 term	71785	353-18-10-001	1
0683-1035	R:Fxd, Comp, 10K ohms, 5%, 1/4W	01121	CB1035	11
0698-0083	R:Fxd, Met Flm, 1.96K ohms, 1%, 1/8W	28480	0698-0083	2
0698-0085	R:Fxd, Met Flm, 2.61K ohms, 1%, 1/8W	28480	0698-0085	2
0698-3136	R:Fxd, Met Flm, 17.8K ohms, 1%, 1/8W	28480	0698-3136	13
0698-3152	R:Fxd, Met Flm, 3.48K ohms, 1%, 1/8W	28480	0698-3152	1
0698-3156	R:Fxd, Met Flm, 14.7K ohms, 1%, 1/8W	28480	0698-3156	14
0698-3157	R:Fxd, Met Flm, 19.6K ohms, 1%, 1/8W	28480	0698-3157	1
0698-3159	R:Fxd, Met Flm, 26.1K ohms, 1%, 1/8W	28480	0698-3159	1
0698-3162	R:Fxd, Met Flm, 46.4K ohms, 1%, 1/8W	28480	0698-3162	1
0698-3266	R:Fxd, Met Flm, 23.7K ohms, 1%, 1/8W	28480	0698-3266	1
0698-3358	R:Fxd, Met Flm, 1K ohms, 0.5%, 1/8W	28480	0698-3358	2
0698-3402	R:Fxd, Met Flm, 316 ohms, 1%, 1/2W	28480	0698-3402	1
0698-3404	R:Fxd, Met Flm, 383 ohms, 1%, 1/2W	28480	0698-3404	2
0698-3438	R:Fxd, Met Flm, 147 ohms, 1%, 1/8W	28480	0698-3438	2
0698-3444	R:Fxd, Met Flm, 316 ohms, 1%, 1/8W	28480	0698-3444	1
0698-3446	R:Fxd, Met Flm, 386 ohms, 1%, 1/8W	28480	0698-3446	1
0698-3458	R:Fxd, Met Flm, 348K ohms, 1%, 1/8W	28480	0698-3458	1
0698-3629	R:Fxd, Met Ox, 270 ohms, 5%, 2W	28480	0698-3629	1
0757-0280	R:Fxd, Met Flm, 1K ohms, 1%, 1/8W	28480	0757-0280	3
0757-0317	R:Fxd, Met Flm, 1.33K ohms, 1%, 1/8W	28480	0757-0317	1
0757-0338	R:Fxd, Met Flm, 1.00K ohms, 1%, 1/4W	28480	0757-0338	1
0757-0394	R:Fxd, Met Flm, 51.1 ohms, 1%, 1/8W	28480	0757-0394	2
0757-0395	R:Fxd, Met Flm, 56.2 ohms, 1%, 1/8W	28480	0757-0395	2
0757-0398	R:Fxd, Met Flm, 75 ohms, 1%, 1/8W	28480	0757-0398	1
0757-0426	R:Fxd, Flm, 1.3K ohms, 1%, 1/8W	28480	0757-0426	1

Table 5-5. Numerical Listing of Electrical Parts (Continued)

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
0757-0438	R:Fxd, Flm, 5.11K ohms, 1%, 1/8W	28480	0757-0439	4
0757-0439	R:Fxd, Flm, 6.81K ohms, 1%, 1/8W	28480	0757-0438	2
0757-0440	R:Fxd, Flm, 7.50K ohms, 1%, 1/8W	28480	0757-0440	1
0757-0442	R:Fxd, Flm, 10.0K ohms, 1%, 1/8W	28480	0757-0442	1
0757-0443	R:Fxd, Flm, 11.0K ohms, 1%, 1/8W	28480	0757-0443	9
0757-0446	R:Fxd, Flm, 15.0K ohms, 1%, 1/8W	28480	0757-0446	9
0757-0447	R:Fxd, Flm, 16.2K ohms, 1%, 1/8W	28480	0757-0447	3
0757-0452	R:Fxd, Flm, 27.4K ohms, 1%, 1/8W	28480	0757-0452	1
0757-0458	R:Fxd, Flm, 51.1K ohms, 1%, 1/8W	28480	0757-0458	4
0757-0460	R:Fxd, Met Flm, 61.9K ohms, 1%, 1/8W	28480	0757-0460	9
0757-0465	R:Fxd, Met Flm, 100K ohms, 1%, 1/8W	28480	0757-0465	14
0757-0470	R:Fxd, Met Flm, 162K ohms, 1%, 1/8W	28480	0757-0470	1
0757-0731	R:Fxd, Met Flm, 825 ohms, 1%, 1/4W	28480	0757-0731	1
0757-0752	R:Fxd, Met Flm, 8.25K ohms, 1%, 1/4W	28480	0757-0752	1
0757-0815	R:Fxd, Met Flm, 562 ohms, 1%, 1/2W	28480	0757-0815	2
0757-0816	R:Fxd, Met Flm, 681 ohms, 1%, 1/2W	28480	0757-0816	1
0757-1090	R:Fxd, Met Flm, 261 ohms, 1%, 1/2W	28480	0757-1090	1
0760-0024	R:Fxd, Met Ox, 100 ohms, 5%, 1W	28480	0760-0024	1
0764-0013	R:Fxd, Met Ox, 56 ohms, 5%, 2W	28480	0764-0013	2
0811-1654	RESISTOR, fixed, ww, 5 ohms, 5%, 20W	28480	0811-1654	2
0811-1674	R:Fxd, ww, 4.7 ohms, 5%, 2W	28480	0811-1674	2
0813-0038	R:Fxd, ww, 0.5 ohms, 10%, 5W	28480	0813-0038	1
1200-0041	SOCKET, transistor	28480	1200-0041	5
1200-0168	SOCKET, transistor	28480	1200-0168	2
1251-0190	PIN, connector, male	28480	1251-0190	1
1251-0337	CONNECTOR, 50 pin	28480	1251-0337	1
1251-0338	INSERT, connector, 50 pin	95238	25-50-SS	1
1251-0339	CONNECTOR, housing	28480	1251-0339	1
1251-2357	CONNECTOR, receptacle, power	82389	AC3G	1
1400-0084	FUSEHOLDER	75915	342014	1
1500-0226	CLUTCH	16554	8EC-11CC-43	1
1820-0123	INTEGRATED CIRCUIT	12040	LM300	2
1853-0041	TSTR, Si, PNP	02735	38640	2
1854-0071	TSTR, Si, NPN (selected from 2N3704)	28480	1854-0071	34
1854-0072	TSTR, Si, NPN	80131	2N3054	2
1854-0217	TSTR, Si, NPN	80131	2N3442	4
1854-0246	TSTR, Si, NPN	80131	2N3643	2
1901-0049	Diode, Si, 0.75A, 50 piv	04713	SR1358-6	1
1901-0081	Diode, Si, 50 VW	07263	FD 1415	39
1901-0200	Diode, Si, 100 piv, 3A	02735	1N4998	10
1902-0035	Diode, breakdown, 120V, 5%	04713	1N3008B	1
1902-0041	Diode, breakdown, 5.11V, 5%	04713	SZ10939-98	1
2100-1758	R:Var, ww, 1K ohms, 5%, 1W	28480	2100-1758	2
02748-6003	READ HEAD ASSEMBLY	28480	02748-6003	1
02748-60034	CONTROL PCA	28480	02748-60034	1
02748-60035	INTERFACE PCA	28480	02748-60035	1
02758-20468	SOLENOID	28480	02758-20468	1
02758-6004	POWER SUPPLY PCA	28480	02758-6004	1
3101-0729	SWITCH, pushbutton	28480	3101-0729	1
3140-0446	MOTOR, shaded pole	28480	3140-0446	1

Table 5-5. Numerical Listing of Electrical Parts (Continued)

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
3140-0496	MOTOR, shaded pole, 230V, 50 Hz	28480	3140-0496	1
3160-0222	FAN ASSEMBLY	28480	3160-0222	1
3160-0224	FAN ASSEMBLY, tubeaxial	99743	WS210F-510	1
5080-1570	SWITCH, pushbutton	28480	5080-1570	1
5080-7149	LINE FILTER	28480	5080-7149	1
8120-1348	POWER CORD	28480	8120-1348	1
8120-1378	POWER CORD	28480	8120-1378	1
8120-1478	CABLE ASSEMBLY	28480	8120-1478	1
9100-1234	TRANSFORMER, power	28480	9100-1234	1
9100-2801	CHOKE, 2 ohms, 1A	28480	9100-2801	1

Table 5-6. Numerical Listing of Mechanical Parts

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TO
0370-0118	PUSHBUTTON	28480	0370-0118	4
0370-1400	PUSHBUTTON	28480	0370-1400	1
1251-0190	PIN, connector, male	28480	1251-0190	1
1390-0107	BUTTON LATCH	13061	810-81	5
1410-0045	BUSHING, bronze, 0.315 OD, 0.189 ID	28480	1410-0045	2
5000-0052	PLASTIC TRIM	28480	5000-0052	2
5000-0734	SIDE COVER	28480	5000-0734	2
5000-8015	GUARD, fan	28480	5000-0815	1
5000-8720	SIDE COVER	28480	5000-8720	2
5020-0900	EXTRUSION, bottom	28480	5020-0900	1
5020-0901	EXTRUSION, top	28480	5020-0901	1
5020-6850	EXTRUSION, bottom	28480	5020-6850	1
5020-6851	EXTRUSION, top	28480	5020-6851	1
5020-1917	STANDOFF	28480	5020-1917	2
5060-0222	HANDLE ASSEMBLY, side	28480	5060-0222	2
5060-0765	HANDLE RETAINER	28480	5060-0765	2
5060-0767	FOOT ASSEMBLY	28480	5060-0767	4
5060-0878	FILTER, air, fan	28480	5060-0878	1
5060-8306	LUBRICATING KIT	28480	5060-8306	1
5060-8736	HANDLE RETAINER	28480	5060-8736	2
5060-8741	RACK MOUNTING KIT	28480	5060-8741	1
7120-0137	DECAL, high voltage	83309	3521	3
8520-0017	BRUSH, nylon	28480	8520-0017	1
02748-0001	PANEL	28480	02748-0001	1
02748-0002	CONTAINER, paper tape	28480	02748-0002	1
02748-0003	PLATE	28480	02748-0003	1
02748-0004	BRACKET, panel	28480	02748-0004	2
02748-0006	REAR PANEL	28480	02748-0006	1
02748-00062	TOP COVER	28480	02748-00062	1
02748-00063	REAR PANEL	28480	02748-00063	1
02748-00064	CONTAINER, paper tape	28480	02748-00064	1
02748-00065	CONTROL PANEL	28480	02748-00065	1
02748-00066	COVER, top	28480	02748-00066	1
02748-00067	PANEL	28480	02748-00067	1
02748-00068	PLATE	28480	02748-00068	1
02748-00069	CONTROL PANEL	28480	02748-00069	1
02748-2001	SHAFT, pinch roller	28480	02748-2001	2
02748-2005	BEARING PLATE	28480	02748-2005	1
02748-2009	ROLLER, material handling	28480	02748-2009	2
02748-2011	IDLER SHAFT	28480	02748-2011	2
02748-2013	SPACER	28480	02748-2013	3
02748-2014	CASTING	28480	02748-2014	1
02748-6002	ACCESSORY KIT	28480	02748-6002	1
02748-60036	FRAME	28480	02748-60036	2
02748-90032	2748B TAPE READER OPERATING AND SERVICE MANUAL	28480	02748-90032	1
02758-0001	READ HEAD COVER	28480	02758-0001	1
02758-0002	PC GUIDE BRACKET	28480	02758-0002	1
02758-0003	PC GUIDE BRACKET	28480	02758-0003	1
02758-0004	DECK PLATE	28480	02758-0004	1
02758-0013	BRACKET, spring	28480	02758-0013	1

Table 5-6. Numerical Listing of Mechanical Parts (Continued)

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
02758-0015	GASKET, read head	28480	02758-0015	1
02758-0016	SHIELD	28480	02758-0016	1
02758-00167	MOUNTING BRACKET, solenoid	28480	02758-00167	1
02758-0168	READ HEAD COVER	28480	02758-0168	1
02758-2008	PC GUIDE	28480	02758-2008	2
02758-2017	PINCH ROLLER	28480	02758-2017	1
02758-2020	ARM LOAD and PINCH ROLLER	28480	02758-2020	1
02758-2023	SHAFT, load and pinch roller	28480	02758-2023	1
02758-2029	DRIVE SHAFT, main capstan	28480	02758-2029	1
02758-20464	SHIELD, high voltage	28480	02758-20464	1
02758-20465	SPACER BLOCK	28480	02758-20465	4
02758-20466	SPACER BLOCK	28480	02758-20466	1
02758-6017	EXTENDER BOARD	28480	02758-6017	1
02758-6019	BOTTOM COVER	28480	02758-6019	1
02758-60225	BOTTOM COVER	28480	02758-60225	1
02758-8006	LABEL	28480	02758-8006	4

Table 5-7. Reference Designations and Abbreviations

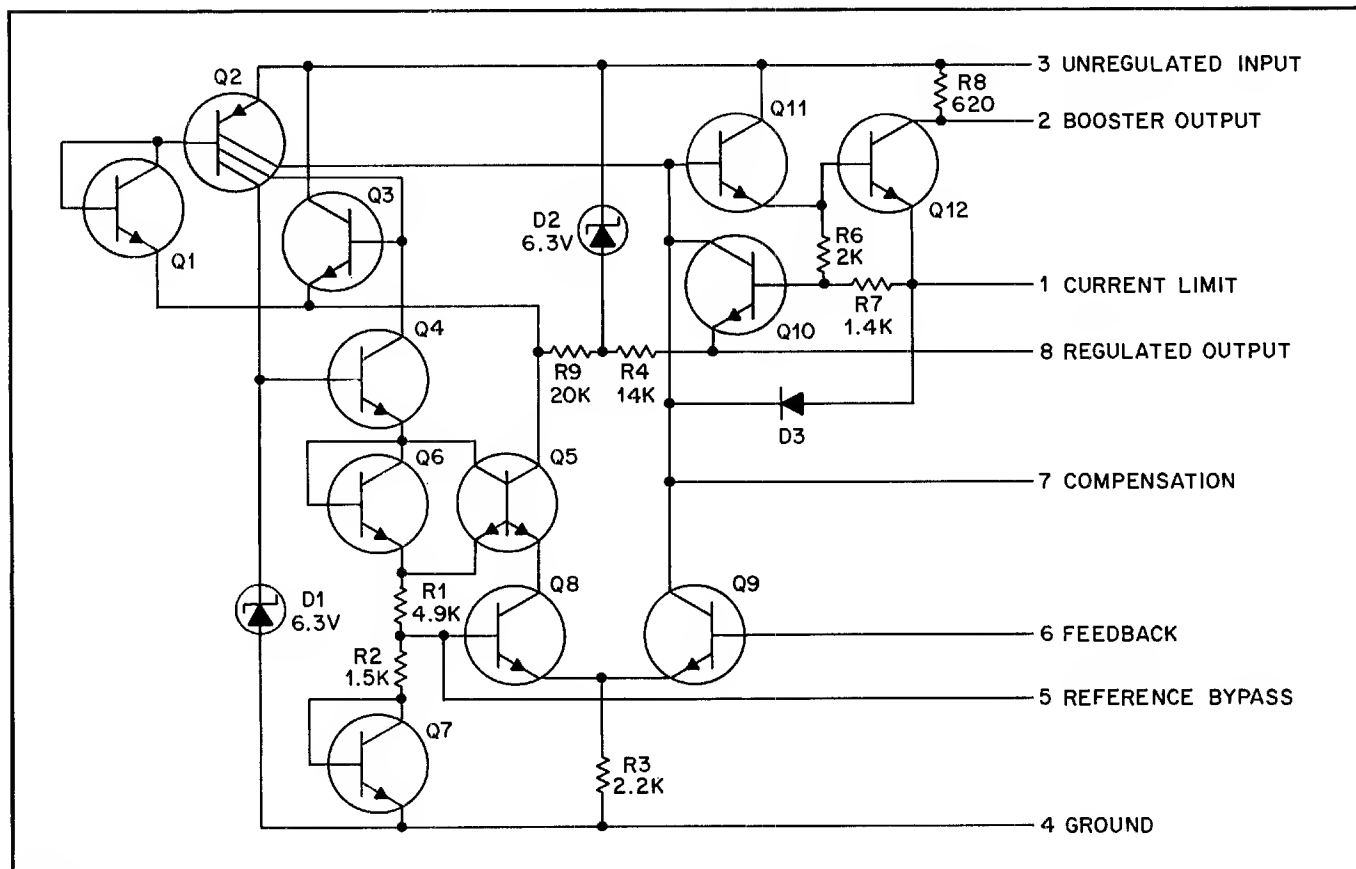
REFERENCE DESIGNATIONS		
A = assembly B = motor, synchro BT = battery C = capacitor CB = circuit breaker CR = diode DL = delay line DS = indicator E = Misc electrical parts F = fuse FL = filter J = receptacle connector	K = relay L = inductor M = meter P = plug connector Q = semiconductor device other than diode or integrated circuit R = resistor RT = thermistor S = switch T = transformer	TB = terminal board TP = test point U = integrated circuit, non-repairable assembly V = vacuum tube, photocell, etc. VR = voltage regulator W = jumper wire X = socket Y = crystal Z = tuned cavity, network
ABBREVIATIONS		
A = amperes ac = alternating current Ag = silver Al = aluminum ar = as required adj = adjust assy = assembly b = base bp = bandpass bpi = bits per inch blk = black blu = blue brn = brown brs = brass Btu = British thermal unit Be Cu = beryllium copper cpi = characters per inch coll = collector cw = clockwise ccw = counterclockwise cer = ceramic com = common crt = cathode-ray tube CTL = complementary-transistor logic cath = cathode Cd pl = cadmium plate comp = composition conn = connector compl = complete dc = direct current dr = drive DTL = diode-transistor logic depc = deposited carbon dpdt = double-pole, double-throw dpst = double-pole, single-throw em = emitter ECL = emitter-coupled logic ext = external encap = encapsulated elctlt = electrolytic F = farads FF = flip-flop flh = flat head flm = film fxd = fixed filh = fillister head G = giga (10^9) Ge = germanium gl = glass gnd = ground(ed)	gra = gray grn = green H = henries Hg = mercury hr = hour(s) Hz = hertz hdw = hardware hex = hexagon, hexagonal ID = inside diameter IF = intermediate frequency in. = inch, inches I/O = input/output int = internal incl = include(s) insul = insulation, insulated impgrg = impregnated incand = incandescent ips = inches per second k = kilo (10^3), kilohm lp = low pass m = milli (10^{-3}) M = mega (10^6), megohm Myl = Mylar mfr = manufacturer mom = momentary mtg = mounting misc = miscellaneous met. ox. = metal oxide mintr = miniature n = nano (10^{-9}) nc = normally closed or no connection Ne = neon no. = number n.o. = normally open np = nickel plated NPN = negative-positive-negative NPO = negative positive zero (zero temperature coefficient) NSR = not separately replaceable NRFR = not recommended for field replacement OD = outside diameter OBD = order by description orn = orange ovh = oval head oxd = oxide p = pico (10^{-12}) PC = printed circuit	PCA = printed-circuit assembly PWB = printed-wiring board phh = phillips head pk = peak p-p = peak-to-peak pt = point prv = peak inverse voltage PNP = positive-negative-positive pwv = peak working voltage porc = porcelain posn = position(s) pozi = pozidrive rf = radio frequency rdh = round head rms = root-mean-square rwv = reverse working voltage rect = rectifier r/min = revolutions per minute RTL = resistor-transistor logic s = second SB, TT = slow blow Se = selenium Si = silicon scr = silicon controlled rectifier sst = stainless steel stl = steel spcl = special spdt = single-pole, double-throw spst = single-pole, single-throw Ta = tantalum td = time delay Ti = titanium tgl = toggle thd = thread tol = tolerance TTL = transistor transistor logic U(μ) = micro (10^{-6}) V = volt(s) var = variable vio = violet Vdcw = direct current working volts W = watts ww = wirewound wht = white WIV = working inverse voltage yel = yellow

Table 5-8. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 and H4-2, and their latest supplements.					
Code No.	Manufacturer	Address	Code No.	Manufacturer	Address
01121	Allen Bradley Co.	Milwaukee, Wis.	71785	Cinch Manufacturing Co.	
02735	Radio Corp. of America			Howard B. Jones Div.	Chicago, Ill.
	Semiconductor and		72136	Electro Motive Manufacturing	
	Materials Division	Somerville, N.J.		Company, Inc.	Willimantic, Conn.
04713	Motorola Inc., Semiconductor		75915	Littlefuse, Inc.	Des Plaines, Ill.
	Products Division	Phoenix, Arizona	80131	Electronic Industries Association,	
07263	Fairchild Camera & Inst. Corp.,			Standard tube or semi-conductor device,	
	Semiconductor Div.	Mountain View, Cal.		any manufacturer.	
12040	National Semiconductor Corp.	Danbury, Conn.	82389	Switchcraft, Inc.	Chicago, Ill.
13061	Wilco Products	Detroit, Mich.	83309	Electrical Specialty Co.	San Francisco, Cal.
16554	Electroid Co.	Union, N.J.	95238	Continental Connector Corp.	Woodside, N.Y.
28480	Hewlett-Packard Co.	Palo Alto, Cal.	99743	IMC Magnetics Corp,	
56289	Sprague Electric Co.	North Adams, Mass.		Western Div.	Maywood, Cal.

A-1. Figure A-1 is an equivalent schematic diagram for the National Semiconductor Corporation LM 300 integrated circuit voltage regulator used in power supply PCA

A1 (A1U1 and A1U2). The Hewlett-Packard part number for the integrated circuit is 1820-0123.



2227-27

Figure A-1. Voltage Regulator Equivalent Schematic Diagram

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